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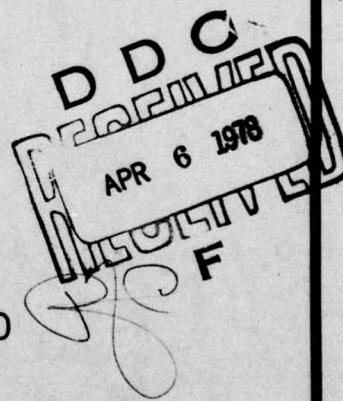
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FEASIBILITY OF UTILIZING MDCS
TO SUPPORT POT&I PROGRAM

March 1976

Prepared for
PERA(CRUDES)
PHILADELPHIA NAVAL SHIPYARD
Philadelphia, Pennsylvania

Under Contract N00140-76-D-0813-0003



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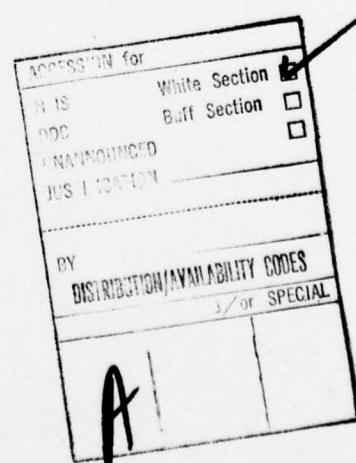
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LB

ABBREVIATIONS

- 2K
 - OPNAV 4790/2K, Ship's Maintenance Action Form
- 3M
 - Maintenance and Material Management
- AEL
 - Allowance Equipment List
- APL
 - Approved Parts List
- ARL
 - Landing Craft Repair Ship
- CID
 - Component Identification
- CSMP
 - Current Ship's Maintenance Project
- DART
 - Detection, Action, Response Technique
- DATC
 - Development and Training Center
- EIC
 - Equipment Identification Code
- IMA
 - Intermediate Maintenance Activity
- INSURV
 - Board of Inspection and Survey
- JSN
 - Job Sequence Number
- MDCS
 - Maintenance Data Collection Subsystem
- MIP
 - Maintenance Index Page
- NA
 - Not Applicable
- NAVSEC
 - Naval Ship Engineering Center
- OPNAVINST
 - Chief of Naval Operations Instruction
- PEB
 - Propulsion Examining Board
- PERA(CRUDES)
 - Planning and Engineering for Repairs and Alterations
(Cruisers and Destroyers)
- POT&I
 - Pre-Overhaul Test and Inspection
- RIR
 - Repair Inspection Record
- ROH
 - Regular Overhaul
- SFOMS
 - Ship's Force Overhaul Management System
- SWBS
 - Ship's Work Breakdown Structure
- SYSCOM
 - Systems Command
- TSU
 - TYCOM Support Unit
- UIC
 - Unit Identification Code



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INTRODUCTION AND SUMMARY

1.1 GENERAL

This report presents the results of a study to determine the feasibility of utilizing the Maintenance Data Collection Subsystem (MDCS) of the Maintenance and Material Management (3M) Program to support Pre-Overhaul Test and Inspection (POT&I). The study was conducted for PERA(CRUDES) by ARINC Research Corporation under Contract N00140-76-D-0813, Task Order 0003.

This study was basically concerned with the impact of using the MDCS Ship's Maintenance Action Form (OPNAV 4790/2K, Figure 1) to record certain test/inspection/repair information currently recorded on the Repair Inspection Record (RIR, Figure 2). Task elements included;

- a. Determination of the effect on the 4790/2K (hereafter referred to as "2K") form if used to record the information and parameters specified in the current POT&I plan,
- b. Determination of corresponding effects on the Current Ship's Maintenance Project (CSMP), the MDCS, and other documentation/procedures, and
- c. Identification of possible solutions and required changes to utilize the MDCS for recording and processing POT&I program information.

1.2 APPROACH

For purposes of this study, a promising method of utilizing the MDCS and existing POT&I practices in combination during ROH planning was hypothesized. This method consists of the following approach:

- a. Use blocks 1-15 of the RIR (see Figure 2) to record POT&I planning data.
- b. Upon conduct of POT&Is, record maintenance requirements on the 2K form, (see Figure 1).

In this hypothesized procedure, a single 2K form would be prepared, where appropriate, to cover the maintenance requirements of each RIR. The boundaries established for each RIR would be as defined in the General POT&I Index (Appendix 2, Technical Specification 4730-100).

The effects, advantages and disadvantages of the above hypothetical approach were examined relative to the following specific maintenance management functions:

- a. Screening and authorization of ROH work

OPNAV 4780/2E (Rev. 6-73)		SHIP'S MAINTENANCE ACTION FORM (2-KILO)				CONT	DEFL																
SECTION I. IDENTIFICATION		JOB CONTROL NUMBER																					
		1. SHIP'S WIC	2. HULL CENTER	3. JOB SEQ. NO.	4. API/ALL	5. EQUIPMENT HIGH NAME	6. EQUIPMENT LOW NAME	7. C	8. C	9. C	10. C	11. C	12. C										
A. SHIP'S NAME										Y	Y	Y	Y										
B. HULL NUMBER		13. IDENT / EQUIPMENT SERIAL NUMBER				14. EIC				P	P	P	P										
15. SAFETY WARNING		16. LOCATION (Compartment/Deck/Floor/Side)				17. WHEN DISCOVERED DATE YR DAY																	
18. ALTERATIONS (SEPAULT, CRALY, Pd Chg., etc.)						19. S/F **		20. DEFER. DATE YR DAY		21. S/F HOURS REM. YR DAY		22. DEADLINE DATE YR DAY											
CONFIGURATION CHANGE						FOR INSUR. USE		FOR INSUR. USE		FOR INSUR. USE		FOR INSUR. USE											
10. HULL NUMBER						J1. TYPICAL		J2. URGENT		J3. URGENT		J4. URGENT											
SECTION II. DEFERRAL ACTION		23. S/F HOURS EXP.				24. DEFER. DATE YR DAY				25. S/F HOURS REM. YR DAY													
SECTION III. COMPLETED ACTION		26. ACT. TIME		27. S/F HOURS		28. COMPLETION DATE YR DAY		29. ACT. TIME		30. S/F HOURS		31. COMPLETION DATE YR DAY		32. ACT. MINT. TIME		33. 7/34. METER READING							
SECTION IV. REMARKS/DESCRIPTION		35. REMARKS/DESCRIPTION																					
36. COMP. SUMMARY																							
37. FIRST CONTACT/HM (P/MIN.)		38. RATE		39. SECOND CONTACT/SUPERVISOR (P/MIN.)		40. INTEGRATED PRIORITY		41. PRI		42. T/A		43. TYCOM AUTHORIZATION		SCREENING									
C. DIV. INIT.		D. DEPT. INIT.		E. COMMANDING OFFICER'S SIGNATURE		F. TYCOM AUTHORIZATION		44. IUC		45. TYCOM													
SECTION V. SUPPLEMENTARY INFORMATION																							
46. BLUEPRINTS, TECH. MANUALS, PLANS, ETC.		47. AVAILABLE ON BOARD YES NO		48. PREARRIVAL/ARRIVAL CONFERENCE ACTION/REMARKS																			
SECTION VI. REPAIR ACTIVITY PLANNING/ACTION																							
49. REPAIR WIC		50. EST. HOURS		51. ASST. REPAIR WIC		52. ASST. EST. HOURS		53. SCHED. START DATE YR DAY		54. SCHED. COMP. DATE YR DAY		55. REPAIR ACTIVITY WIC				56. WORK REQ. ROUTINE		57. EST. MANHOURS		58. EST. MANHOUR COST \$		59. EST. MATERIAL COSTS \$	
60. EST. TOTAL COST \$		61. JOB ORDER NUMBER		62. LEAD PER CODE		63. DATE OF EST. YR DAY		64. FINAL ACT.		65. HRS EXPENDED YR DAY		66. DATE COMPLETED YR DAY		67. COMPLETED BY (Signature - Rate/Bank)		68. ACCEPTED BY (Signature - Rate/Bank)							

PLANNING AND ANALYSIS DATA

CONDITION AND RECOMMENDED MAINTENANCE

MAINTENANCE
PLANNING

Figure 1. OPNAV 4790/2K, Ship's Maintenance Action Form

REPAIR INSPECTION RECORD (ND-PNSY-9310/8)															
1. SHIP & HULL NO.															
2. NAME OF EQUIPMENT			3. SYSTEM			4. WBS/NO.		5. ITEM/NO.							
6. LOCATION						7. APL/CID									
8. ACTIVITY		9. CODE/NO. MEN	10. CODE/NO. MEN	11. CODE/NO. MEN	12. DURATION			13.							
					(A) TEST	(B) INSP		DRYDOCK							
								PIER							
								SEA							
14. S.F. ASSISTANCE AND PREPARATION REQUIRED:															
S.F. CONTACT															
W.C.															
MIP NO.															
16. INSPECTION/TEST DESCRIPTION AND REFERENCES: TECH. MAN. NO. TEST MEMO NO. PLAN NO.															
16. CONDITION/TEST RESULTS CODE 190/240/225			17. INSP. NAME			19. CODE	20. DATE								
21. RECOMMENDATIONS (SY/FAI):															
22. JOB TITLE				23. FCN		24. JCN		25. EIC							
SHOP	11	17	24	26	31	36	38	41	51	56	64	67	71	72	99
27. PLANNER I.D.				SALES ESTIMATE											
28. M/H	29. MAT'L	30. M/H		31. LABOR		32. OY/HO		33. MAT'L		34. TOTAL					

Figure 2. Sample Repair Inspection Record (RIR)

- b. ROH work planning, including the management and control of shipyard, IMA, and ship's force work
- c. Management and control of INSURV deficiencies
- d. Reliability, maintainability and maintenance history analysis.

1.3 SUMMARY OF CONCLUSIONS

The following conclusions were drawn from this study.

1.3.1 Combining MDCS/POT&I Procedures

Accomplishing ROH planning by recording POT&I planning data in blocks 1-15 of the RIR, and recording maintenance requirements using the 2K form, is considered feasible. This practice has the advantage that it would reduce redundancy by eliminating the need to record material condition and maintenance requirements in blocks 16 and 21 of the RIR. Additional advantages of this practice include the following:

- a. Traceability between the POT&I program and the ROH work package would be enhanced, resulting in increased ability to develop POT&I program standards and evaluate POT&I program effectiveness.
- b. It is responsive to the intent of OPNAVINST 4790.4 that maintenance data collection or reporting requirements other than those specified in the 3M manual are not to be levied on the Fleet without CNO approval.

1.3.2 RIR Boundary Definitions

Utilizing current RIR boundary definitions as the basis for preparing 2Ks (i.e., preparing one 2K for each RIR) has both advantages and disadvantages. Advantages are that this practice standardizes the level of 2K reporting, reduces the number of line items that must be controlled during ROH, and enhances traceability between the POT&I program and the ROH work package. The general disadvantage is that some degree of detail is sacrificed with respect to precise identification of accomplishing activity, priority, and equipment (i.e., APL/CID).

The nature of the effects, advantages and disadvantages of utilizing RIR boundary definitions is summarized in Table 1, relative to the specific maintenance management functions previously mentioned. The conclusions summarized in Table 1 are further discussed in Section 3.

1.3.3 EIC/SWBS Interface

The combined utilization of the POT&I program and MDCS in accomplishing ROH will be affected by the extent to which EIC-SWBS interface problems are resolved. Hence, in the long run the best method of tracking between RIRs and 2Ks will depend on the manner in which the single-language concept is eventually implemented within the Navy. There are several feasible interim solutions, including:

- a. Entering the SWBS number in block 14 (EIC), or block 46 (Special Purpose) of the 2K form.

TABLE 1. IMPACT OF USING RIR BOUNDARY DEFINITIONS TO PREPARE 2Ks

MAINTENANCE MANAGEMENT FUNCTION	IMPACT OF UTILIZING RIR BOUNDARY DEFINITIONS		
	EFFECT	ADVANTAGES	DISADVANTAGES
Work definition, including screening and authorization	Work items (i.e., each RIR) often combine maintenance requirements of more than one echelon of maintenance, more than one level of priority and more than one reason for deferral.	Fewer 2Ks to process during screening; work on related equipments and same system is integrated into a single form.	Complicates decision making process when defined work item is "partially approved". Sacrifices visibility and control of parts of the work item relative to priority and accomplishing activity.
Management and control of shipyard ROH work	Based on existing practices sometimes more than one job order would be required to cover a given RIR item; in a few cases, more than one RIR item would be combined into a single job order.	In cases where RIR boundary definitions are compatible with job order boundary criteria, traceability between work requests and job orders is improved.	In cases where RIR boundary definitions differ from job order boundary criteria, traceability becomes more difficult.
Management and control of IMA ROH work	IMA work, in some cases, would be combined with shipyard or ship's force work into a single item.	Eliminates certain source data redundancy when IMMS is used.	None
Management and control of ship's force ROH work	Ship's force work in some cases would be combined with yard or IMA work into a single item; in other cases, the requirements of more than one work center would be combined into a single 2K.	Eliminates certain source data redundancy when SFOMS is used.	Visibility and control at the "accomplishing work center" level is sacrificed when management of ship's force package not supported by SFOMS.
Maintenance history, reliability and maintainability analysis	Instance of combining more than one APL/CID item onto a single 2K is greatly increased. Hence, percentage of maintenance actions classified in machinery history reports as "NO APL" would increase.	None	Visibility provided by maintenance history summaries that are based on APL (e.g., "DART" listings and "Logistics High Failure Report(s)") is decreased. Automatic analysis capability in essence shifts from APL level to EIC level.
Management and control of INSURV deficiencies	Work items (i.e., each RIR) would sometimes combine more than one INSURV deficiency.	None	Visibility and accountability of INSURV deficiencies through CSMP is decreased.

- b. Entering the applicable SWBS and item numbers (as appearing in blocks 4 and 5 of the RIR) into block 35 or 46 of the respective 2K.
- c. Entering the applicable POT&I item key number (from the CRUDES POT&I Index) into block 35 or 46 of the 2K.

1.3.4 Maintenance Planning/Reporting

A review of three recent FF-1052 Class ROH programs shows that relative level of maintenance planning/reporting varies from ship to ship and equipment to equipment. In some cases, one RIR resulted in one work request, which in turn resulted in one shipyard job order. In other instances, one RIR resulted in several work requests, which in turn resulted in one job order. On rare occasions, several RIRs resulted in one work request and one shipyard job order. Appendix A elaborates on this matter on a system-by-system basis.

In certain respects it would be advantageous if there were common rules governing the level of reporting used in all records associated with maintenance management. This would be difficult, if not impossible, to achieve due to the diverse needs of maintenance planning and maintenance analysis. A compromised approach to ROH planning might be warranted, i.e.,

- a. Where appropriate, prepare more than one 2K to cover a given RIR. The basis for preparing more than one 2K would be to limit each 2K to maintenance requirements of a single priority level and a single accomplishing activity.
- b. Provide a means to ensure positive traceability between RIRs and 2Ks.
- c. Relax existing 3M rules to permit utilization of the term "Various" in blocks 4 (APL/AEL), 13 (Ident/Equip. Serial No.) and 16 (Location) of the 2K.

1.3.5 RIR vs. SWBS Level of Detail

In most cases the level of detail defined by current RIRs is at least as great as the degree of detail defined by the three-level SWBS. In fewer cases the RIR level of detail is as great as the four-digit EIC. Table 2 substantiates this conclusion at the major shipboard system level. Appendix B summarizes the comparative levels of RIR/SWBS/EIC detail relative to individual subsystems/equipments. The data contained in Table 2 and Appendix B form the basis for the following conclusions:

- a. Since RIRs are usually written at a lower level than the SWBS third level, the POT&I program would benefit from expansion of SWBS.
- b. If it is desired to create a degree of POT&I visibility and control comparable to the three-level EIC, then certain RIRs should be subdivided. (Appendix B identifies those RIRs that are candidates for subdivision).

1.3.6 Other Alternatives

The main objective of this study was to examine the effects, advantages, and disadvantages associated with the hypothesis described in Section 1.2. Related alternatives or variations may be equally worthy of consideration, as discussed in Section 4.

TABLE 2. COMPARISON OF RIR, SWBS AND EIC REPORTING LEVELS

SWBS NO.	MAJOR SYSTEM	TOTAL NO. OF POT/I (RIR) ITEMS			DEGREE OF DETAIL - POT/I (RIR) ITEMS RELATIVE TO SWBS (3RD LEVEL) (NO. OF POT/I ITEMS WITH:)			RELATIVE TO EIC (3RD LEVEL) (NO. OF POT/I ITEMS WITH:)			GREATER DETAIL
		LESS DETAIL	SAME DETAIL	GREATER DETAIL	LESS DETAIL	SAME DETAIL	GREATER DETAIL	LESS DETAIL	SAME DETAIL	GREATER DETAIL	
100	HULL STRUCTURE	33	6	17	10	6	6	19	19	8	
200	PROPULSION PLANT	55	0	7	48	8	8	19	19	28	
300	ELECTRIC PLANT	22	0	7	15	7	7	8	8	7	
400	COMMAND & SURVEILLANCE	108	0	18	90	91	91	15	15	2	
500	AUXILIARY SYSTEMS	108	1	19	88	21	21	31	31	56	
600	OUTFIT & FURNISHINGS	35	1	23	11	9	9	12	12	14	
700	ARMAMENT	27	0	5	22	16	16	3	3	8	
	TOTAL	388	8	96	284	158	158	107	107	123	

BACKGROUND

2.1 POT&I PROGRAM

The current POT&I program for surface ships (less carriers) consists of two steps:

- a. A POT&I plan is prepared to identify all tests and inspections required to develop a complete repair package with a designated inspection activity for each. This plan includes:
 - 1) An index of the ROT&I items planned for the ship
 - 2) A set of RIR forms (see Figure 2) for the items
 - 3) Test procedures and data sheets
- b. The POT&I, as prescribed in the plan, is conducted and results prepared in the form of a POT&I report. The report includes:
 - 1) All completed RIR sheets, with test/inspection results recorded in block 16 and scope of repair recommendations recorded in block 21.
 - 2) Applicable supplementary reports (INSURV, PEB, etc.)
 - 3) Applicable Maintenance Action Forms (4790/2K), filled out for applicable items of deferred maintenance.
 - 4) Completed test procedures used during execution of the POT&I.

The POT&I program is conducted in accordance with PERA(CRUDES) Technical Specification No. 4730-100.

2.2 MAINTENANCE DATA COLLECTION SUBSYSTEM

The MDCS is the means by which deferred and completed maintenance actions are recorded, stored, and retrieved for specified categories of equipments. The essence of MDCS is the 2K form. The scope of the program, instructions for completing the 2K form and related criteria and procedures are contained in the Ships 3M Manual, OPNA VINST 4790. 4.

2.3 SIMILARITIES IN 2K and RIR

Many of the data elements recorded on the 2K and RIR forms are similar. Figure 3 illustrates the common and unique elements of the two forms. The considerable commonality of content suggests the possibility that POT&I program requirements and objectives can be at least partially supported within the current framework of MDCS. The feasibility of such action is discussed in Section 3.

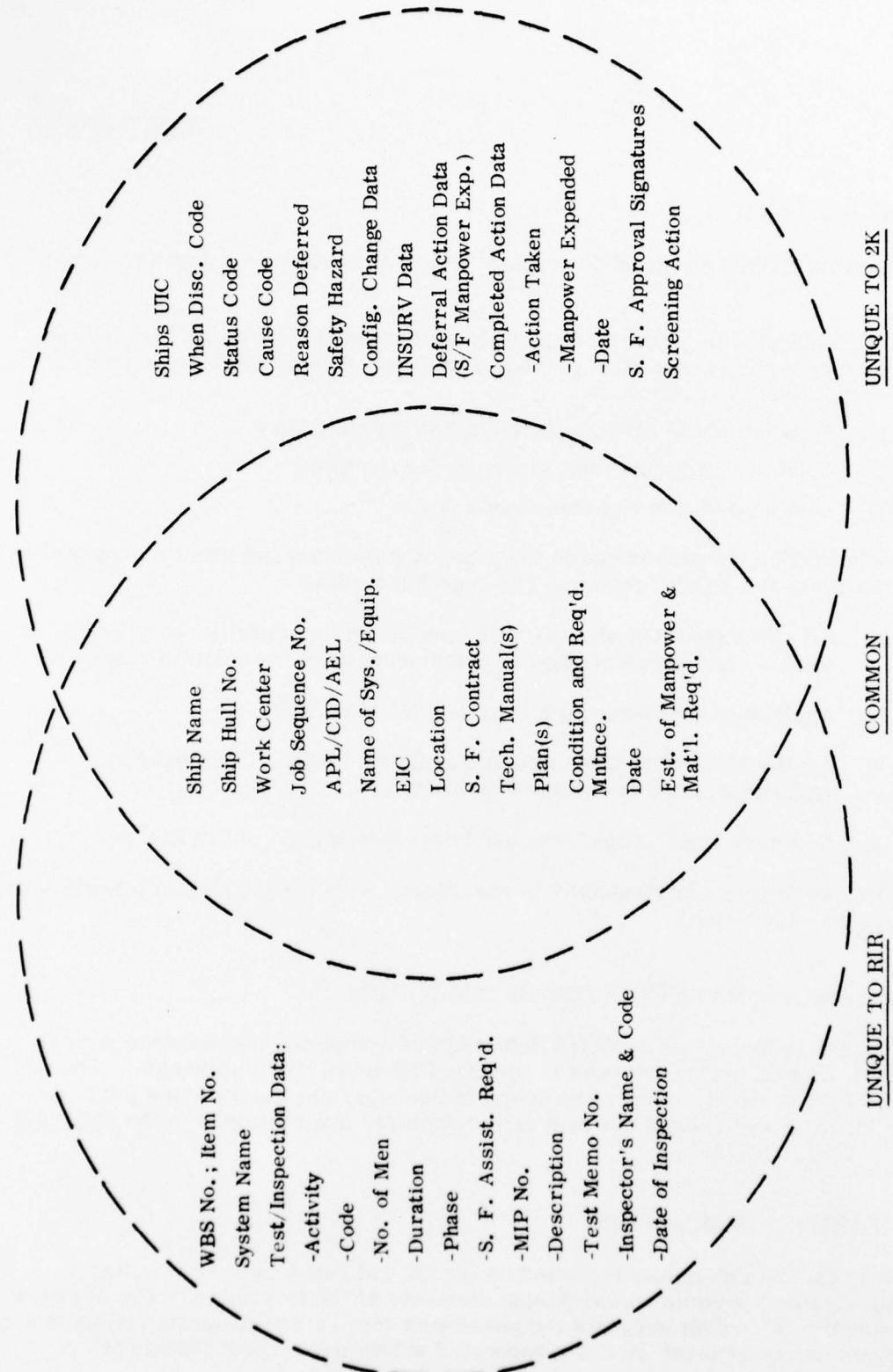


Figure 3. Data Elements on RIR and 2K Forms

ANALYSIS

This section describes the effects of utilizing the system/equipment boundary definitions established by POT&I Repair Inspection Records as the basis for generation of Maintenance Action Forms during overhaul planning.

3.1 BACKGROUND

The shaded areas of Figure 4 identify the specific data fields within the 2K form that together define/describe the level of maintenance being recorded. Utilization of the boundary criteria established by RIRs impacts on each of the shaded blocks. The impact is considered herein relative to the following significant maintenance management functions:

- a. Work definition, including screening and authorization
- b. ROH work planning, including the management and control of shipyard, IMA and ship's force work
- c. Reliability and maintainability analyses
- d. Maintenance history analysis
- e. Management and control of INSURV deficiencies.

3.2 DISCUSSION OF AFFECTED DATA ELEMENTS

3.2.1 Work Center

For ships, the work center code is a four-position indicator, based on department, division, and division group. Though some degree of standardization exists in identifying work centers, the precise identifiers vary from ship to ship. It is inferred from OPNAVINST 4790.4 that the work center code entered in block 2 of the 2K form is to be the lead work center for the recorded maintenance action. Likewise, it is inferred from OPNAVINST 4790.4 that a given 2K may define the actions of more than one work center. Repair Inspection Records usually, though not always, define an area of maintenance that is the responsibility of a single work center. Hence, if during ROH planning a single 2K is prepared for each RIR, most 2Ks would involve a single work center. Examples of exceptions include: propulsion control consoles (POT&I item 252-01), main steam piping system (POT&I item 253-01), ventilation system (POT&I item 512-01), painting (POT&I item 631-01), and deck covering (POT&I item 634-01).

The practice of combining the work of more than one work center into a single 2K form limits the utility of the CSMP relative to ship's force work, since it would

OPNAV 4790/2K (Rev. 6-73)

SHIP'S MAINTENANCE ACTION FORM (2-KILD)

SECTION I. IDENTIFICATION		JOB CONTROL NUMBER			
1. SHIP'S VIC	2. HOME CENTER	3. JOB REG. NO.	4. 000/000		
5. SHIP'S NAME		6. EQUIPMENT FIELD NAME			
7. HULL NUMBER		8. IDENT / EQUIPMENT SERIAL NUMBER		9. SIC	
10. SAFETY Hazard		11. LOCATION (Country/Prov./City/Zone/Area)		12. MODE OF CONVEYANCE VEHICLE DAY	
13. COMPLIANCE CHANGE		14. FOR INSURANCE USE			
15. ALTERATIONS (SEPARATE, CRASH, FWD, ETC.)		16. P/F %	17. HOURS SPENT	18. 000/000	19. 000/000
SECTION II. DEFERRAL ACTION		20. S/P HRS. EXP.	21. DEFER. DATE	22. S/P HRS. DUE	23. DEADLINE DATE
		YR.	DAY	YR.	DAY
SECTION III. COMPLETED ACTION		24. ACT. TIME	25. S/P HRS.	26. COMPLETION DATE	27. ACT. MANT. TIME
		YR.	DAY	YR.	DAY
SECTION IV. REMARKS/DESCRIPTION		28. FOR SELECTED EQUIPMENTS ONLY			
29. REMARKS/DESCRIPTION					
30. CDR SUMMARY		31. INTEGRATED PRIORITY			
32. FIRST CONTACT/MAINT. MAN (Print)		33. RATE	34. SECOND CONTACT/SUPERVISOR (Print)		35. T/A
36. DIV. INIT.		37. DEPT. INIT.	38. COMMANDING OFFICER'S SIGNATURE		39. TYCOM AUTHORIZATION
40. SPECIAL PURPOSE		A	B	C	D
		E	F	G	H
		I	J	K	L
		M	N	O	P
		Q	R	S	T
		U	V	W	X
		Y	Z		
SECTION V. SUPPLEMENTARY INFORMATION		41. PREARRIVAL/ARRIVAL CONFERENCE ACTION/REMARKS			
42. BLUEPRINTS, TECH. MANUALS, PLANS, ETC.		43. AVAILABLE ON BOARD YES NO			
44. EST. TOTAL COST \$		45. EST. HRS EXPENDED	46. DATE COMPLETED YR. DAY	47. ACCEPTED BY (Signature - Rate/Book)	
SECTION VI. REPAIR ACTIVITY PLANNING/ACTION		48. REPAIR W/C			
		49. EST. HRS	50. ASST. REPAIR W/C	51. ASST. EST. HRS	52. SCHED. START DATE
					YR. DAY
53. REPAIR ACTIVITY W/C		54. 000/000 ROUTINE	55. EST. BANDAYS	56. EST. HANDDAY COST \$	57. EST. MATERIAL COST \$
58. EST. TOTAL COST \$		59. JOB ORDER NUMBER	60. LEAD PRE CODE	61. DATE OF EST. YR. DAY	
62. FINAL ACT.		63. HRS EXPENDED	64. DATE COMPLETED YR. DAY	65. COMPLETED BY (Signature - Rate/Book)	
66. ACCEPTED BY (Signature - Rate/Book)					

Figure 4. OPNAV Form 4790/2K, Showing Data Fields That Establish Level of Maintenance

provide listings that are based on lead rather than accomplishing work centers. Hence, summaries of estimated manpower requirements as provided in CSMP reports would become less meaningful at the work center level. It should be noted that the Ship's Force Overhaul Management System (SFOMS), if used, could compensate for any loss of detail within the CSMP.

3.2.2 APL/CID/AEL

As prescribed in OPNAVINST 4790.4, the APL/CID/AEL of the equipment being reported is to be entered in block 4 of the 2K. It is further stipulated that "Not Listed" or "Not Applicable" be entered, as appropriate. The 3M manual does not specify reporting level, implying that a single 2K can cover any appropriate level of maintenance from "boiler" to "safety valve". It is inferred from the 3M manual, however, that grouping more than one APL/CID/AEL within a single 2K form is not intended.

In most cases, RIRs are written at a level that embraces more than one APL/CID/AEL. (The data presented in Appendix C identify the ship systems/equipments that normally include more than a single APL/CID/AEL.) Consequently, implementation of the practice of preparing one 2K for one RIR would require refinement of 3M criteria to permit multiple APL/CID/AEL coverage on a given 2K. This would require that, where appropriate, "Various" be entered in block 4. Such a procedure would not detract from the utility of the CSMP, since APL/CID/AEL is not a basis for control in CSMP summary reports. It would, however, limit the utility of the 2K as an ROH planning document since the 2K is now sometimes used as a reference source in identifying APL/CID/AEL. It is noted that other sources (e.g., the COSAL "E" deck, and planned/actual shipyard MIS data banks) could also provide this reference.

The most significant effect of multiple APL/CID/AEL reporting is in the summary and analysis of completed maintenance actions. It is intended that the MDCS be capable of producing maintenance history information and supporting reliability/maintainability analysis at the lowest possible level of APL/CID/AEL identification. Several existing programs (e.g., the Navy Detection, Action, Response Technique Program) depend on APL/CID/AEL level information. Table 3 provides a sample listing of the specific MDCS report products that are based on or list the APL/CID/AEL.

Implementation of the "one 2K for one RIR" concept would in general decrease the percentage of MDCS data relatable to individual APL/CID/AEL items. The significance of this effect varies from item to item, depending on whether that item contains "many" or "few" different APL/CID/AELs. Appendix C provides data illustrating, on a case-by-case basis, the degree to which each ship system equipment would be affected by multiple APL/CID/AEL reporting in the MDCS.

3.2.3 Equipment Noun Name

As specified in the 3M manual, the noun name of the equipment/system covered by a given 2K is entered in block 5. The noun name is limited to 16 positions. The 3M manual also specifies that, where applicable, the AN designation for electronic equipments will be used instead of noun name.

In completing 2Ks from boundaries defined by the RIRs, administrative rules regarding use of abbreviations and use of RIR nomenclature are warranted in order

TABLE 3. MDCS DATA PRODUCTS BASED ON APL/AEL (SAMPLE)

MSO Control Number	Report Title	Description	Use		
			Management Information	Analysis	R&M
4790.S2704.D-10	Report of Completed Repair/ Alteration Actions (Condensed)	History of all maintenance, repair, and alterations in sequence by work center, EIC, ID serial number and job sequence number; APL/AEL listed; narrative also listed.		X	
4790.S2704.F-06	Material History (Detailed Record)	History of all actions, displayed in sequence accomplished. Lists APL/AEL; includes narrative and failed-parts data.		X	
4790.S33300	APL Merit Listing	Listing of APLs in rank order, based on man-hours expended, parts cost, and number of deferrals for parts or assistance.	X		
4790.S3321-01	Organizational Summary Report (by APL)	Listing of total parts cost, man-hours expended and number of actions by APL for a given ship and period.	X		X
4790.S2711-01	Logistics High Failure Equipment Report	Rank-order listing of EIC items showing distribution of actions by APL/AEL. Rank based on weighted consideration of eight factors.	X (DART)	X	X
4790.S3015	DART Tracking Report	Listing of eight factors for each hull within each (or selected) EIC/APL (DART).	X (DART)		
4790.S2739	APL Data Listing	Listing of various data for each reported action, organized by APL/AEL.	X	X	
4790.S2946	Reported Code Summary - by APL	Summary of all maintenance actions for given APL item by type of action taken.		X	

to enhance traceability between the POT&I program and the work package. However, the recording of noun name does not significantly affect any of the ROH planning or maintenance management functions being considered in this report.

3.2.4 Status

In documenting deferred maintenance actions, block 7 of the 2K is used to record the code that most accurately describes the operational performance capability of the item. Codes applicable to this block are:

- 1 = Operational
- 2 = Non-operational
- 3 = Reduced capability
- 0 = Not applicable

The entry in block 7 would normally be affected by the system/equipment level being recorded. For example, if a 2K were prepared for a single forced draft blower, the block 7 entry might be "Non-operational". Conceivably, under the same circumstances, if the 2K were prepared at the combustion air system level, the entry in block 7 might appropriately be "Reduced Capability". Status information, as appearing in block 7, is not included within CSMP reports and its use in conduct of ROH planning functions is not apparent. However, this information is used in measurement of reliability since it contributes to identification of failures.

3.2.5 Cause

Block 8 of the 2K form is used to record cause of failure, malfunction, or need for maintenance. When more than one reason applies, the primary cause is entered. The following codes are used in recording cause:

- 1 = Abnormal environment
- 2 = Manufacturer/installation defects
- 3 = Lack of knowledge or skill
- 4 = Communication problems
- 5 = Inadequate instruction/procedure
- 6 = Inadequate design
- 7 = Normal wear and tear
- 0 = Not applicable

The information entered in block 8 is affected by the system/equipment level being reported. In general, the higher the reporting level the less meaningful the cause information. The cause code entered in block 8 is not included in CSMP reports and is considered to be of limited value during ROH planning. Cause information is potentially useful in performing reliability and related analysis based on maintenance history, but it is not apparent that this information is being utilized to any great extent.

3.2.6 Reason for Deferral

Block 9 is used to enter the code that best describes the reason maintenance cannot be performed at the time of deferral. The following codes apply, for deferral:

- 1 = Ship's force work backlog/operational priority
- 2 = Lack of material
- 3 = No formal training in this equipment
- 4 = Formal training inadequate in this equipment
- 5 = Inadequate school practical training
- 6 = Lack of facilities/capabilities
- 7 = Not authorized for ship's force accomplishment
- 8 = For ship's force overhaul or availability work list
- 9 = Lack of technical documentation
- 0 = Other, or not applicable

As in the case of "status" and "cause" codes, the usefulness of deferral reason, as entered in block 9, decreases as the scope of the maintenance item becomes broader.

CSMP reports contain and, in certain cases, are organized by deferral reason. The data provide visibility that can be useful in performance of screening during ROH planning, and of maintainability and related logistics analysis. The extent to which deferral data are actually used for these purposes is not readily apparent.

3.2.7 Identification/Equipment Serial No.

As prescribed in the 3M manual, block 13 of the 2K form is used to record the identification or serial number of the maintenance item being recorded. Where appropriate, the terms "Various" or "NA" can be designated. The recording of maintenance items at a more general level will increase the frequency with which the term "Various" is used. While this would detract from the visibility provided by the 2K and CSMP reports (when used during ROH planning), the degree of detraction does not appear to be significant.

3.2.8 Equipment Identification Code (EIC)

The first four of the seven positions in block 14 are used to record applicable EIC, as taken from the EIC Master Index. In the four-character EIC, the first character denotes system (e.g., F000, propulsion system); the second character, subsystem (e.g., F300, main condensate and main feed systems); and the last two, equipment (e.g., F308, main feed booster pump).

The intent of the 3M System is that normally the equipment level of recording will apply, although entry of system (F000) or subsystem (F300) codes can be appropriate. In most cases, RIR items are prepared at the same or lower level than the EIC third indenture level. Notable exceptions to this statement include the main steam piping system, switchboards, refrigeration plant and most electronics. (The specific ship systems/equipments whose RIR level normally differs from EIC

equipment level are identified in Appendix B.) It is concluded that preparation of 2Ks using boundary definitions established by RIRs would not significantly affect the utility of the EIC as used in the CSMP and MDCS (except for the aforementioned systems/equipments).

3.2.9 Location

Block 16 of the 2K form is used to record the compartment/deck/frame/side at which the reported item is located. While it is implied that equipment located in more than one compartment would not be combined into a single 2K, this is often done in practice. Preparation of 2Ks using RIR boundary definitions would in some cases impact on existing practices relative to entering the equipment location on the 2K. For example, in some instances the location identification might be possible to only the compartment rather than to the exact frame and side. In other instances it may be necessary to use the term "Various" in block 16. While some visibility may be sacrificed regarding location, the overall impact of using RIR boundary definitions is not considered significant.

3.2.10 INSURV Number

One of the purposes of the MDCS is to provide for the accounting of INSURV deficiencies. In this regard, the MDCS is used to record deficiencies originally identified by INSURV as well as those identified by ship's force prior to INSURV. This is accomplished by the entry of a deficiency code in block 20.

The use of RIR boundary definitions as the basis for 2K preparation would conflict with prescribed INSURV accounting practices only in the event the POT&I program is conducted immediately subsequent to INSURV, since it is conceivable that an RIR item could involve more than a single INSURV deficiency.

3.2.11 Priority

Block 41 of the 2K is used to record the priority applicable to the maintenance being deferred. The following codes are used (definitions of the priority levels are given in the 3M Manual):

- 1 = Mandatory
- 2 = Essential
- 3 = Highly Desirable
- 4 = Desirable

The primary purpose of the priority code is to assist personnel in the process of work approval or in conducting tradeoffs during availability planning. Other potential uses are in assessing material condition or in performing reliability analyses. Utilization of RIR boundary definitions would increase the occurrence of combining into a single 2K those maintenance requirements having varying priority levels. This would detract from the usefulness of the 2K and the CSMP, particularly with respect to work definition.

3.2.12 Accomplishing Activity

Identification of accomplishing activity is noted by the screening action entered in blocks 44 and 45. The following codes apply:

- 1 = Depot (shipyard or ship repair facility) accomplish
- 2 = IMA (tender/repair ship, etc.) accomplish
- 3 = TSU (TYCOM support unit/ARL/floating dry dock/DATC, etc.) or other technical assistance
- 4 = Ship's force
- 5 = Ship's force assisted by IMA/depot
- 6 = Ship to shop
- 7 = Accomplish with modification
- 8 = Disapproved
- 9 = Remove from CSMP. Pass to history (to be assigned by TYCOM only)

In defining deferred maintenance requirements, it is important that the work to be accomplished by each echelon of maintenance be entered on a separate 2K. This criterion is important from the standpoint of the screening, planning, and analysis functions. In many instances a given RIR item will result in work requirements that involve more than one accomplishing activity. In these instances, preparing a single 2K for a given RIR could detract from the utility of the MDCS.

3.3 IMPACT ON CSMP

Section 2 described the impact of integrating POT&I and MDCS practices on certain general maintenance management functions. It is also important to consider this impact specifically in terms of CSMP data products.

3.3.1 CSMP

As described in OPNAVINST 4790.4 the CSMP is the basic tool used by ship's force, TYCOM, SYSCOMs, shipyards, and PERA to manage deferred shipboard maintenance. The essence of the CSMP is a set of summary listings generated periodically as requested and distributed to ship's force and other interested agencies. Three types of reports can be generated:

- a. Report Type 1 – A single line summary of each incompletely completed maintenance action reported on a 2K by ship's force. This report type can be printed in any one of several different optional formats (e.g., by type of availability, managing work center, INSURV number, only safety items, or EIC). Figure 5 is an example of a Report Type 1.

CURRENT SHIPS MAINTENANCE PROJECT REPORT 1 - OPTION E							PRINTED 23 JUN 74		
USS SPRINGFIELD CLG-7 UIC-#3566			IUC-CCDL			PAGE- 9			
EIC	W/C	JSN	MONU NAME	IDENT	CSMP SUMMARY				
1494	E891	1198	DECK GRATING	B-1-1	REPLACE ALUMINUM DECK GRATING	22DEC73	6	3	2
319C	E891	1977	SSTG RED GEAR	1-2	THERMOMETER WELLS NOT SECURED	17NOV73	2	3	4
F181	E891	1155	SUPERHEATER GAGE	1	DISTANT READ THERMOMETER INOP	8MAY73	4	3	1
F393	E892	1585	MAIN FEED PUMP	4	PUMP END SHAFT SLEEVE SCORED	9APR73	2	4	2
F491	E891	1121	FDB INSTRUMENTS	1 TO 6	TACHS AND THERMOS MISSING	9JAN73	2	3	4
F597	E891	1157	FOH QUIK CLO VLV	1-2	PROTECTIVE SHIELDS NOT INSTAL	9DEC73	2	1	2
T896	E891	1187	FIRE/FLUSH PUMP	1	TURBINE CASING FLANGE LEAKS	17APR73	6	2	1
T998	E891	1836	FUEL OIL PIPING	VARIOUS	7 IN FUEL OIL LINE DETERIORATED	19NOV72	6	3	1
TH98	E891	1619	VALVE WHEELS	VARIOUS	VALVE WHEELS AND LABELS MISSING	18FEB73	6	3	4
TH98	E891	1621	PIPE HANGERS	VARIOUS	HANGERS UNBOLTED CUT OR MISSING	19FEB73	6	3	4
TH94	E891	1698	HP/LP STEAM TRAPS	VARIOUS	IMPULSE STEAM TRAPS LAGGED	19JUN73	6	3	4
TH94	E891	1725	LO PRESS DRAINS	B-2	INVERTED FUNNELS MISSING	12AUG73	2	2	1
U698	O891	1978	ELECTRONICS INSP	NO IDENT	PROVIDE RFI SURVEY	3AUG73	6	3	1
M24	O892	1918	CAQ1-6198	700558	REQUIRES REPAIR AND CALIBRATION	26FEB73	2	3	2
M28J	O892	1919	AN/TRM-3	110	REQUIRES REPAIR AND CALIBRATION	26FEB73	2	3	2
TCB4	WD21	9855	GRAVITY DAVITS	STARBD	DAVITS OUT OF ALIGNMENT	3SEP71	2	3	1
TCB5	WD21	1999	WINCH	PORT 2	DECK RUSTED AND PITTED	17JUL73	2	3	1

Figure 5. Example of CSMP Report Type 1

- b. Report Type 2 – A detailed record of each submitted deferral, organized by JSN within work center. Figure 6 is an example of this report type.
- c. Report Type 3 – Contains the same information as report type 2 except that it is organized by EIC.

3.3.2 Uses of CSMP Reports

CSMP reports can be used for a variety of purposes, including:

- a. Determining material condition of the ship, ship system, equipment (as defined by the EIC), and work center.
- b. Estimating manpower requirements for all echelons of maintenance.
- c. Scheduling work
- d. Providing a baseline from which to develop an ROH work package.
- e. Specifying certain details relating to maintenance requirements.

3.3.3 Analysis of Impact

Figure 7 illustrates the specific information fields within the 2K that provide the basis for CSMP reports. It is reasoned that any criterion affecting the information content of the shaded blocks will impact on the CSMP. In general, criteria which dictate the recording of data in its most elementary form contribute to the utility of the CSMP, while criteria which allow grouping of maintenance elements into broader items detract from the utility of the CSMP.

The practice of utilizing RIR boundary definitions in preparing 2Ks specifically impacts on the data blocks shaded in Figure 7. Table 4 describes the nature of the effect, and its impact in terms of the previously mentioned CSMP uses.

CURRENT SHIPS MAINTENANCE PROJECT REPORT		PRINTED 23 JAN 74	
DETAIL LISTING BY JCN		PAGE 21	
WORK CENTER EB#1	UIC-COL		
JSN NOUN NAME	EIC IDENT	DEF DATE	DEF REASON
1077 SSTG RED GEAR	B10C	17 NOV 73	LACK OF MATERIAL THERMOMETER WELLS ARE NOT SECURED WITH WIRE AND LEAD SEALS
1121 FDB INSTRUMENTS	F401	1 TO 6 9 JAN 73	LACK OF MATERIAL TACHOMETER GAGES AND THERMOMETERS ARE MISSING OR DAMAGED BEYOND ECONOMICAL REPAIR XXX
1157 FOH QUIK CLO VLV	F507	9 DEC 73	REPAIR DEFECTIVE UNITS FUEL OIL HEATER QUICK CLOSING VALVE DOES NOT HAVE PROTECTIVE SHIELDING INSTALLED IAW NSSTM 9480-93 AND 9880-1486 XXX FABRICATE AND INSTALL
1187 FIRE/FLUSH PUMP	T896	17 APR 73	LACK FACIL/CAPAB 2 DEPOT ACCOMPLISH TURBINE CASING LEAKS EXCESSIVELY AT FLANGES BETWEEN HALVES SEVERAL ATTEMPTS BY TENDERS TO CORRECT UNSUCCESSFUL XXX REPAIR CASING LEAKS AND RESTORE OTHER COMPONENTS TO ORIGINAL SPECS
1190 DECK GRATING	1404	BT1	FIRST CONTACT JOHNSON BT1
1191 LADDERS	1401	22 DEC 73	LACK FACIL/CAPAB 3 TYCOM SUPP UNIT REPLACE ALUMINUM DECK PLATING XXX FABRICATE AND INSTALL DECK GRATING ON UPPER LEVEL BETWEEN NR 1 AND 2 BOILERS AND BOLT IN PLACE
1194 SMOKE PIPE	F601	22 DEC 73	IMA ACCOMPLISH 2 BOTH INCLINED LADDERS HAVE EXCESSIVELY WORN BENT AND SLIPPERY TREADS XXX REPLACE TREADS
		28 DEC 73	DEPOT ACCOMPLISH 1 SMOKE PIPE BETWEEN ECONOMIZER AND 3RD DECK DETERIORATED TO THE POINT WHERE EXCESSIVE AMOUNTS OF SOOT AND GASES ARE BLOWING OUT INTO FIRE ROOM CAUSING A HEALTH PROBLEM ON THE UPPER LEVEL XXX RENEW ALL Affected SECTIONS OF CASING AND REPLACE GASKETS
		BT1	SECOND CONTACT JOHNSON BT1 DAILY BRC

Figure 6. Example of CSMP Report Type 2

SHIP'S MAINTENANCE ACTION FORM (2-KILO)				COMP	DEFER
JOB CONTROL NUMBER					
SECTION I. IDENTIFICATION		1. SHIP'S MIC	2. HOME CENTER	3. JOB REG. NO.	4. APL/ALC
5. SHIP'S NAME		6. EQUIPMENT ITEM NAME		7. 1 2 3 4 5 6 7 8 9 10 11 12	
8. Hull Number		13. ID/CTN / EQUIPMENT SERIAL NUMBER		14. EIC	
9. SAFETY HAZARD		15. LOCATION (Department/Deck/Room/Space)		16. WHEN CHECKED DATE YR. DAY	
10. ALTERATIONS (SHIPALT, CRAFTALT, FIC Chg., etc.)		11. A/cntn		12. MOUNT NUMBER	
13. CONFIGURATION CHANGE		14. FOR INSUR. USE		15. SUPPLY U. S. 823.5 77	
SECTION II. DEFERRAL ACTION					
23. S/F HOURS EXP.		24. DEFER. DATE YR. DAY		25. S/F HOURS REM. YR. DAY	
FOR SELECTED EQUIPMENTS ONLY					
SECTION III. COMPLETED ACTION					
29. ACT. TKN		30. S/F HOURS YR. DAY		31. COMPLETION DATE YR. DAY	
32. ACT. MAINT. TIME		33. T/L. DA. METER READING			
SECTION IV. REMARKS/DESCRIPTION					
34. MAINTENANCE ACTIVITIES					
35. CAMP SUMMARY					
36. FIRST CONTACT/MAINT. MAN (PRINT)		38. RATE		40. SECOND CONTACT/SUPERVISOR (PRINT)	
41. 42. 43. INTEGRATED PRIORITY				44. 45. 46. SCREENING	
C. DIV. INIT. D. DEPT. INIT. E. COMMANDING OFFICER'S SIGNATURE		F. TYCOM AUTHORIZATION		47. 48. 49. TYCO	
SECTION V. SUPPLEMENTARY INFORMATION					
47. BLUEPRINTS, TECH. MANUALS, PLANS, ETC.		48. AVAILABLE ON BOARD YES NO		49. PREARRIVAL/ARRIVAL CONFERENCE ACTION/REMARKS	
SECTION VI. REPAIR ACTIVITY PLANNING/ACTION					
50. REPAIR W/C		51. EST. HOURS		52. ASST. REPAIR W/C	
53. ASST. EST. HOURS		54. SCHED. START DATE YR. DAY		55. SCHED. COMP. DATE YR. DAY	
56. REPAIR ACTIVITY U/C		57. EST. HOURS		58. EST. HOURS	
59. EST. HOURS		60. EST. HOURS		61. EST. MATERIAL COST \$	
62. EST. TOTAL COST \$		63. JOB ORDER NUMBER		64. LEAD PRE CODE	
65. FINAL ACT		66. HOURS EXPENDED YR. DAY		67. DATE OF EST YR. DAY	
68. DATE COMPLETED YR. DAY		69. COMPLETED BY (Signature - Rate/Rank)		70. ACCEPTED BY (Signature - Rate/Rank)	

Figure 7. OPNAV 4790/2K, Showing Data Fields Used in CSMP

TABLE 4. IMPACT OF RIR BOUNDARY DEFINITION ON CSMP

2K DATA ITEMS IN CSMP		EFFECT OF RIR BOUNDARY DEFINITION	CSMP USES				
2K BLOCK	TITLE		Determining Material Condition	Estimating Manpower Requirements	Scheduling Work	Establishing Work Package	Specifying Maintenance Requirement Details
A	Ship's Name	None	X				
B	Hull Number	None	X				
1	UIC	None	X				
2	Work Center	In some cases the work of more than one work center would be combined into a single item; work center identified would sometimes represent "lead" center	X	X	X		X
3	Job Sequence No.	None			X	X	X
5	Noun Name	None				X	X
9	Reason for Deferral	In some cases, the work defined by a single 2K would represent multiple reasons for deferral.				X	X
13	Identification/Equipment Serial Number	Would increase usage of the term "VARIOUS"	X			X	X
14	EIC	Would, in many cases, limit identification to second, rather than third, level of indenture.	X		X	X	
15	Safety Item Identification	None	X				
20	INSURV Number	Sometimes, more than one deficiency would be included on a single 2K.	X				X
26	Deferral Date	None	X				
27 50 52 57	Estimated Manpower	Estimates would be made at broader levels	X	X	X	X	
35	Remarks/Description	Descriptions of material condition and statements of required maintenance would in general be more extensive than present practice	X		X	X	X
37	CSMP Summary Title	None				X	X
38 39	First Contact	None					X
40	Second Contact	None					X
41	Priority	In some cases, multiple priority level work would be included in same 2K	X			X	
42	Type of Availability	None	X	X		X	
44 45	Screening Action	In some cases, multiple accomplishing activity work would be included in same 2K.	X	X		X	

ANALYSIS OF ALTERNATIVE METHODS

4.1 INTRODUCTION

Section 3 of this report discussed the advantages and disadvantages associated with one specific approach to integration of POT&I Program and MDCS practices during ROH planning. Certain variations to that approach might be considered. Figure 8 illustrates four potentially promising methods. Method 2 has already been discussed in detail in Section 3; the other three potential methods are discussed below:

4.2 METHOD 1: ELIMINATE USE OF RIR BLOCK 21

4.2.1 Description of Method 1

In this approach, the RIR would be used to record POT&I planning data (blocks 1-14), procedures (block 15), and material condition (block 16), but not maintenance requirements (block 21). This information would be used as the basis for generating a set of 2Ks covering work requests intended for incorporation into the ROH work package. It is assumed under this method any number of 2Ks (including none at all) could result from each RIR.

4.2.2 Analysis of Method 1

In this approach, all existing practices relative to completing the RIR (other than the requirement that recommended maintenance be recorded in block 21) would remain as currently specified in TS 4730-100. No change to the OPNAV Form 4790/2K would be necessary. The following changes to procedures for filling out the form would, however, be required:

- a. Current instructions prescribe that both "condition" and "recommended maintenance" be included in block 35 of the 2K. Under Method 1, this instruction would be modified to eliminate need for reporting "condition".
- b. Since, in Method 1, the POT&I report partially depends on the MDCS, it would be virtually essential that there be positive traceability from "maintenance items" to "POT&I items". There are a variety of ways in which this could be accomplished, including any of the following:
 - 1) Add SWBS number (3 digit) to the 2K form in block 14, 35, or 46.
 - 2) Add SWBS and item number for the related POT&I (5 digit) in either block 35 or 46.
 - 3) Add POT&I key number (6 digit), as appearing in the CRUDES Class POT&I Index, in block 35 or 46.

The principal advantage of this approach is that it does eliminate some degree of redundancy and has minimum impact on existing 3M procedures and practices.

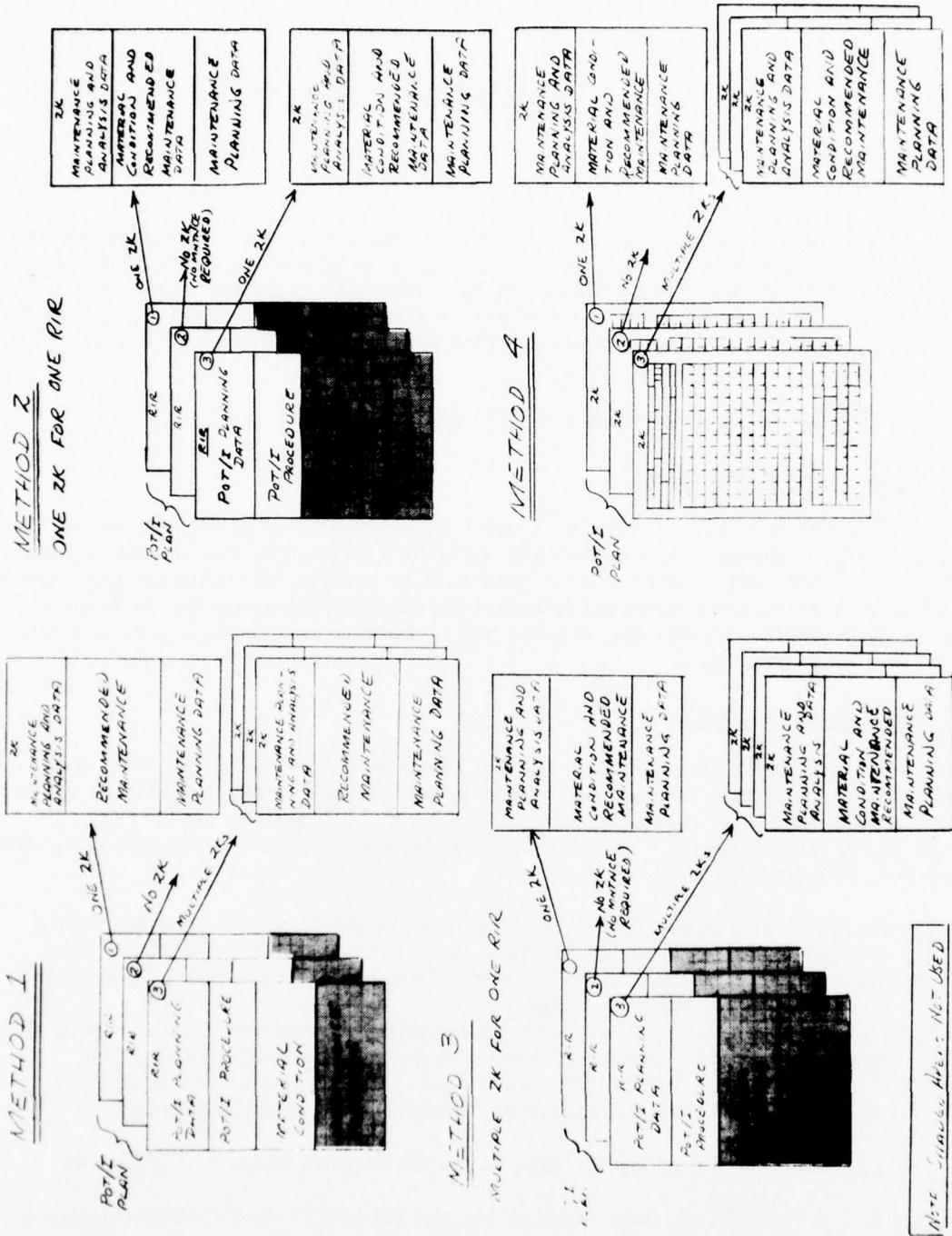


Figure 8. Alternative Methods of ROH Planning

4.3 METHOD 3. PREPARE MULTIPLE FORM 2Ks, AS APPROPRIATE

4.3.1 Description of Method 3

This method would be similar to Method 2 except that the constraint that 2Ks be prepared on a one-for-one basis with RIRs would be removed. Under this proposed method, criteria for preparing 2Ks would be basically as follows:

- a. For each given RIR, separate 2Ks would be prepared to cover the maintenance requirements of each echelon (i.e., ship's force, IMA, and yard) of maintenance.
- b. For each given RIR, separate 2Ks would be prepared to cover each level of priority.
- c. "Various" APL items can be grouped into a single 2K.
- d. Various serially-numbered or identification-numbered items can be grouped into a single 2K.
- e. "Location", as entered in block 16 of the 2K, can be limited to compartment. "Various" can be entered in that block, as appropriate.

4.3.2 Analysis of Method 3

The significant advantage to this approach is that it reduces existing redundancy in source data generation, and maximizes the traceability between the POT&I and MDCS programs without significantly detracting from ROH planning functions. The principal disadvantage is that, like Method 2, significant visibility regarding the reliability and maintainability of individual APL items would be sacrificed. In a more specific sense, this would mean, for example, that current maintenance history analyses such as DART would be limited to rankings or measurements based on EIC instead of APL.

4.4 METHOD 4. ELIMINATE RIR

4.4.1 Description of Method 4

In this approach, the CSMP would totally replace the RIR as the major vehicle for recording POT&I planning and reporting data. Accordingly, POT&I planning data (i.e., data now recorded in blocks 1-15 of the RIR) would be recorded using a 2K, and processed (including entry into the CSMP). When POT&Is are conducted, one or more separate 2Ks are prepared, if appropriate, to record deferred maintenance requirements. The original 2K covering the conduct of the POT&I item is reported as a completed action and the new 2Ks covering deferred maintenance entered into the CSMP.

This approach need not affect the format of the 2K. However, certain procedural changes would be required. For example, it would be desirable to provide traceability between related POT&Is. (This could be provided by recording the POT&I key number in block 46.) Also, it would be necessary to broaden the current 3M system definition of "deferred maintenance" to include "POT&I items". Also, since the CSMP would become a major source of POT&I planning visibility, new CSMP report formats would most likely be required. This, together with the increased MDCS reporting load

created by this approach, represents an increased workload on the applicable 3M data processing facility.

Figure 9 illustrates the manner in which, under Method 4, POT&I planning and reporting would interface with the CSMP. As hypothesized, the following procedure would apply:

- a. Prior to (or independent from) POT&I program implementation, ship's force would conduct routine tests, inspections (e.g., PMS, OPPE, etc.) and, where appropriate, prepare 2Ks to cover deferred maintenance. These items would comprise the CSMP.
- b. At a scheduled point in the ROH planning cycle, PERA would compile a ship POT&I plan based on the CSMP and a type/class POT&I plan. An element of that plan would be a set of 2Ks covering the POT&I items. These items would be entered into the CSMP (see Figure 10).
- c. CSMP summary reports, together with the POT&I plan, would provide the tools used in conduct of the POT&I program.
- d. As appropriate, completed action reports for POT&I items are submitted.
- e. Simultaneously, as appropriate, new 2Ks covering deferred maintenance identified during POT&I are prepared and submitted. In preparing the 2Ks, the applicable POT&I control number is recorded on the form (block 46).
- f. The CSMP summary reports, together with the set of 2Ks and supplemental data sheets, where specified, would constitute the POT&I report.

4.4.2 Analysis of Method 4

The principal advantages of Method 4 are that it:

- a. Is responsive to the intent that all shipboard maintenance data collection be within the framework of the 3M system.
- b. Eliminates considerable source data redundancy in ROH planning.
- c. Provides a considerable degree of POT&I automated program planning and reporting, using 3M facilities and capabilities.
- d. Enhances the ability to analyze the effectiveness of the POT&I program.

The principal disadvantages of this method are that:

- a. It requires translation of the present POT&I planning baseline into 2K format and entry into the 3M (or equivalent) data bank.
- b. Timeliness of POT&I planning and reporting would be constrained by 3M data processing capabilities.
- c. Certain POT&I planning data (e.g., MIP number and phasing data) would be sacrificed.

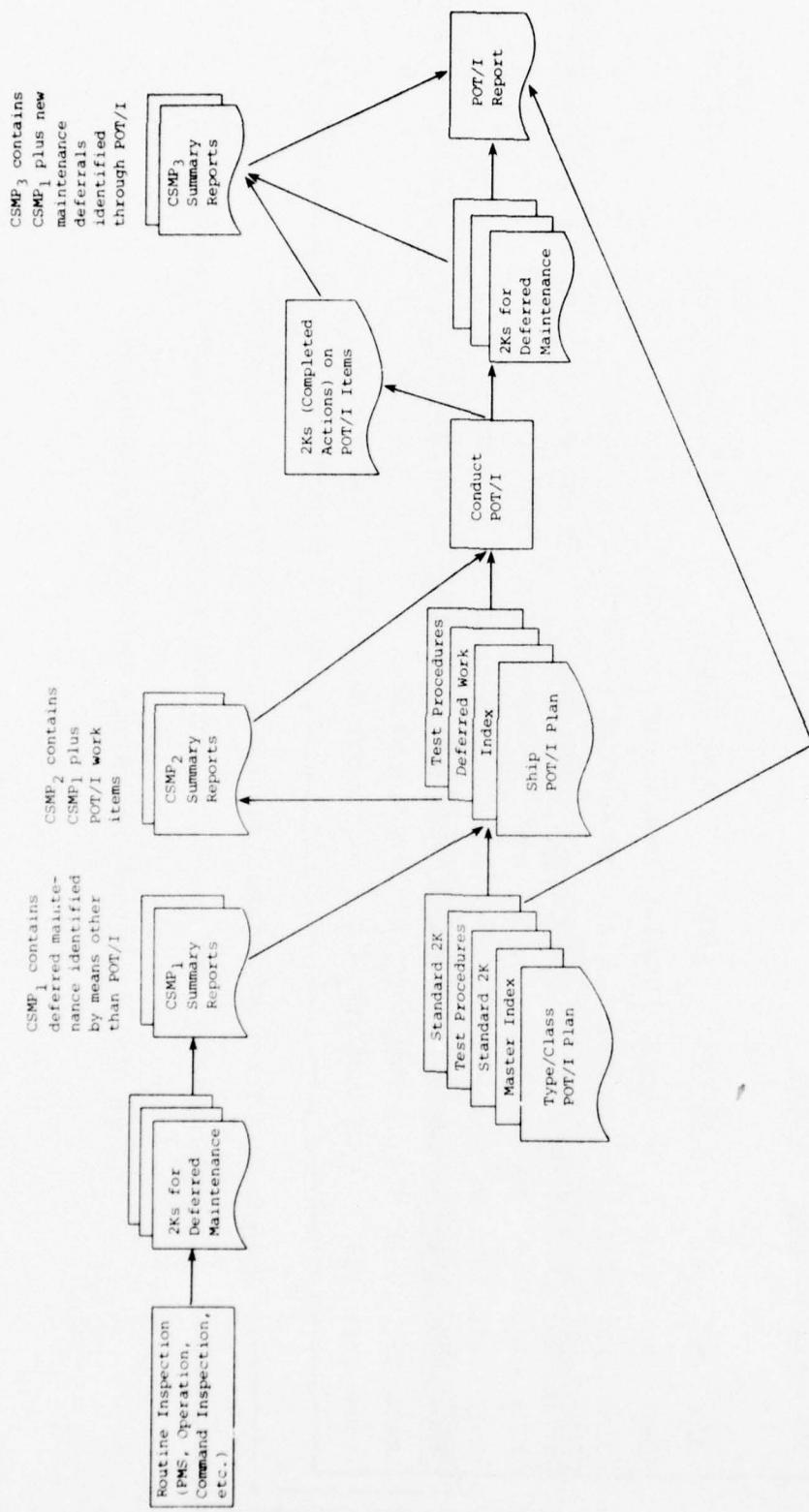


Figure 9. Flow Diagram Highlighting Interfaces Between POT&I Program and MDCCS

CURRENT SHIPS MAINTENANCE PROJECT REPORT 1 - OPTION E

PAGE X

<u>EIC</u>	<u>WC</u>	<u>JSN</u>	<u>NOUN NAME</u>	<u>IDENT</u>	<u>CSMP SUMMARY</u>	<u>DEFR DATE</u>	<u>REASON</u>	<u>PRI</u>	<u>TYPE AVAILABILITY</u>
1404	EB01	1190	DECK GRATING	B-1-1	REPL ALUMINUM GRATING	22 DEC 73	6	3	2
310C	EB01	1077	SSTG RED GEAR	1-2	THERM WELLS NOT SECURED	17 NOV 73	2	3	4
A001	ER01	1234	WT/AT DOORS	VAR	POT/I WT DOORS	10 JAN 74	0	3	4
F101	EB01	1155	SUPERHEATER	1	DIST THERMOMETER INOP	8 MAY 73	4	3	1
F303	EB02	1555	MN FEED PUMP	4	SHAFT SLEEVE SCORED	9 APR 73	2	2	4
P303	EB01	1733	MN FEED PUMPS	ALL	POT/I MN FEED PUMPS	10 JAN 74	0	2	1
F401	EB01	1121	FDB INSTRUMENTS	1-6	TACHS MISSING	9 JAN 73	2	3	4
F506	EB01	1157	QUIK CLOS VLV	1-2	PROTECTIVE SHLDS MISSING	11 NOV 73	2	1	2

Example 1: POT/I item; related deferred maintenance previously defined.

Example 2: POT/I item; no related deferred maintenance previously defined.

Figure 10. Example of CSMP Report That Includes POT&I Items

APPENDIX A

COMPARISON OF RIR, WORK REQUEST, AND JOB ORDER REPORTING LEVELS

The data contained in this appendix are based on a review of recent ROH information for a sample of three FF-1052 class destroyers. The table contains the following for each third-level Ship's Work Breakdown Structure (SWBS) item:

- a. Number of POT&I items, as defined in the General POT&I Index contained in Technical Specification 4730-100.
- b. Number of work requests contained in the ROH work package of each of the three ships sampled (FF-1066, FF-1067, FF-1058).
- c. Average number of work requests for the three ships sampled.
- d. Number of shipyard job orders for each of the three ships sampled.
- e. Average number of job orders for the ships sampled.

The purpose of the data is to illustrate, in a gross sense, that the current degree of compatibility between RIR, work request, and job order boundaries varies from ship to ship and system to system within the ship. A review of the data provides the following observations:

- a. In many items (e.g., SWBS Nos. 114, 313, 523) there currently is apparent compatibility between boundary criteria in that the number of RIRs, work requests and job orders is virtually the same.
- b. In certain cases (e.g., SWBS 251, 255, 311, 521, 631), there is apparent disparity between RIR and work request boundary definitions.
- c. In certain cases (e.g., SWBS 221, 512, 581), there is apparent disparity between RIR and job order boundary definitions.

The data included in this appendix are intended to provide guidance in identifying:

- a. Specific systems/equipments that do not apparently require further consideration with respect to reporting criteria.
- b. Specific RIR items that are candidates for subdivision.
- c. Specific systems/equipments that apparently require additional criteria for determining work request and/or job order boundaries.

WBS NO.	SYSTEM	NO. POT/I ITEMS	NO. OF WORK REQUESTS				NO. OF JOB ORDERS			
			1066	1067	1058	Avg	1066	1067	1058	Avg
C O M M A N D A N D S U R V E I L L A N C E	411 Data Display Group		3			1	3			1
	421 Non-Elect. Elex. NAV Aids	3	2		4	2	2	1	4	2
	422 Elect. NAV Aids	2	5	3	4	3	5	3	2	3
	423 Elex. NAV Systems Radio	3	4			1	4			1
	424 Elex. NAV. Syst. Account.	1	1	1	1	1	1	1	1	1
	426 Elect. NAV. Syst.	3	10	10	22	14	4	5	9	6
	431 Swbds. for I.C. Systems	1		1		1		1		1
	432 Telephone Systems	2	3	6	2	4	3	3	2	3
	433 Announcing Systems	2	1	6	3	3	1	2	1	1
	434 Entertainment & Trn. System	4				-				-
	435 Voice Tubes					-				-
	436 Alarm, Safety & Warn.	1	4	22	5	10	4	1	5	4
	437 Indicating, Order & Metering	2	12	5	13	10	4	3	2	3
	438 Integ. Control System	-				-				-
	439 Recording & Television	-				-				-
	441 Radio Systems	51	12	7	12	10	9	3	5	6
	442 Underwater Systems	1				-				-
	443 Visual & Audible System	5				-				-
	445 TTY and FAX System	19			2	1			2	1
	446 Security Equipment	7				-				-
	450 Surv. Systems (Surf.)	6			7	2			4	1
	451 Surf. Search Radar	1	6	13	9	9	6	4	7	6
	452 Air Search Radar	1	10	6	1	6	6	4	1	3
	454 Aircraft Control Radar									
	455 Ident. Systems (IFF)	6	8		3	4	4		1	2
	462 Passive Sonar	-				-				-
	463 Active/Passive Sonar	2	4	68	7	26	4	5	3	4
	465 Bathythermograph	1				-				-
	471 Active ECM	2	3	4	14	9	6	4	7	6
	472 Passive ECM	9	23	13	9	15	14	9	4	9
	473 Torpedo Decoys	1				-				-
	474 Decoys (Other)									
	475 Degaussing	1		1	1	1		1	1	1
	481 Gun Fire Control System	9	6	13	8	9	4	4	6	15
	482 Fire Control Sys. (Non-Sonar)	9	5	2		2	2	2		1
	483 Fire Control Syst. (Sonar)	11	3		3	2	1		3	1
	489 Fire Control Syst. Swbd.	2				-				-
	491 Elex. Test & C/O Equin.	-		4	1	2		1	1	1
- CONTINUED -										

WBS NO.	SYSTEM	NO. POT/I ITEMS	NO. OF WORK REQUESTS				NO. OF JOB ORDERS			
			1066	1067	1058	Avg	1066	1067	1058	Avg
502	Auxiliary Machinery (General)	-	1	1		2	1	1		1
505	Piping Reqmnts, General	-		1		1		1		1
508	Thermal Insulation, General	-	9	4	1	5	1	1	1	1
511	Compartment Heating	2			1	1				1
512	Ventilation System	1	5	2	13	7	3	2	10	5
513	Mchy Space Vent System	1	10	19		9	2	3		2
514	Air Cond. System	3	9	1	4	5	2	1	4	2
516	Refrigeration System	1	13	6	8	9	2	1	8	3
521	Firemain and Flushing	4	24	17	3	15	2	2	3	2
522	Sprinkler System	1	8	3	17	9	3	3	4	3
523	Washdown System	1			1	1			1	1
524	Auxiliary Sea Water	1			1	2	1		1	1
526	Scuppers & Deck Drains	1	2		3	2	2		3	2
527	Firemain Actuated Services	-			4	1			4	1
528	Plumbing Drainage	1				-				-
529	Drainage & Ballasting	5	5	8	8	7	1	5	6	4
531	Distilling Plant	4	16	15	6	12	1	3	6	3
532	Cooling Water	-			4	1			4	1
533	Potable Water	5		3	13	5		1	3	1
534	Aux. Stm. & Drns. (Mchy Sp.)	11	29	50	13	30	10	27	13	17
535	Aux. Stm. & Drns, (Other)	2	3	7	3	4	3	3	3	3
536	Aux. Fr. Water Cooling	2	7		2	3	2		2	1
541	Ship Fuel & Fuel Comp.	4	16	9	5	10	2	7	5	5
542	Aviation & General Purp. FO	3		4	6	3		2	4	2
543	Aviation & General Purp. LO	2		1		1		1		1
545	Tank Heating	1				-				-
551	Compressed Air System	6	26	16	19	20	5	8	10	8
555	Fire Exting. System	6	2	4	1	2	2	2	1	2
561	Steering Control	1	5	9	12	9	2	3	5	3
562	Rudder	1	1	1	3	2	1	1	1	1
565	Trim and Heel	-	7	4		3	2	1		1
566	Stabilizing Fins	1				-				-
571	Unrep. Systems	2	2	5	3	3	2	2	1	2
572	Ships Stores & Hand. Equip.	1		5	2	2		1	2	1
573	Cargo Handling	1				-				-
574	Vert. Repl. Systems	-				-				-
581	Anchor Handling & Stowage	1	6	9	6	7	3	3	5	4
582	Mooring & Towing	2				-				-
	-CONTINUED -									

WBS NO.	SYSTEM	NO. POT/I ITEMS	NO. OF WORK REQUESTS				NO. OF JOB ORDERS			
			1066	1067	1058	AVG	1066	1067	1058	AVG
583	Boat Handling & Stow.	4	11	20	21	17	6	4	8	6
584	Mech. Op. Doors, Ramps	-								-
588	Aircraft Handling & Stow.	1	5			2	3			1

WBS NO.	SYSTEM	NO. POT/I ITEMS	NO. OF WORK REQUESTS				NO. OF JOB ORDERS			
			1066	1067	1058	Avg	1066	1067	1058	Avg
602	Hull Design and Markings	5	3	3		2	1	1		1
611	Hull Fittings	1	1	2	6	3	1	2	4	2
612	Rails, Stanchions, Life Lns.	2	1		1	1	1		1	1
613	Rigging and Canvas	1	1			1	1			1
621	Non-Structural Blknds	1				-				-
622	Floor Plates & Gratings	1	1		2	1	1		2	1
623	Ladders	3	6		4	3	1		4	2
624	Non-Structural Closures	1	1			1	1			1
625	Airports, Fixed Port Lights	1				-				-
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631	Painting	1	8	15	12	12	8	7	6	7
632	Zinc Coating	-				-				-
633	Cathodic Protection	1				-				-
634	Deck Covering	1	1		2	1	1		2	1
635	Hull Insulation	1	6	1	2	3	3	1	2	2
636	Hull Damping	1				-				-
637	Sheathing	1		1		1		1		1
638	Refrigerated Spaces	1				-				-
640	Living Spaces	2		1	4	2		1	4	2
651	Commissary Spaces	2	7	8	12	9	4	4	7	5
652	Medical Spaces	1				-				-
654	Utility Spaces	1				-				-
655	Laundry Spaces	1	1	3	4	3	1	1	2	1
656	Trash Disposal Spaces	2				-				-
661	Offices	1	1		3	1	1		1	1
662	Machinery Cont. Cntrs. Furn.	1				-				-
663	Elex. Cont. Cntrs Furn.	1				-				-
664	Damage Control Stations	1				-				-
665	Wkshops, Labs, Etc.	1		1	3	1		1	1	1
671	Lockers & Spec. Stowage	1				-				-
672	Storerooms & Issue Rooms	1				-		1	1	
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APPENDIX B

COMPARISON OF RIR, SWBS, AND EIC BOUNDARY CRITERIA

The data contained in this appendix provide a comparison of the relative level of detail defined by:

- a. Repair Inspection Records (RIRs), as defined in the General POT&I Index contained in PERA(CRUDES) Technical Specification 4730-001.
- b. The three-level Ship's Work Breakdown Structure, as defined in NAVSHIPS 0900-039-9010.
- c. The three-level Equipment Identification Code, as defined in the EIC Master Index.

Each RIR, as contained in the General POT&I Index, is listed in the tables of this appendix. The columns reflect degree of detail (i.e., "less", "same" or "greater") of each RIR item relative to SWBS and EIC. The purpose of the information presented in this appendix is to:

- a. Identify RIR items that are candidates for subdivision, if it is desired to enhance commonality between the RIR and SWBS/EIC boundary definitions.
- b. Identify those items that are candidates for SWBS expansion.

	Detail Relative to SWBS						Detail Relative to EIC						Detail Relative to SWBS						Detail Relative to EIC					
	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater			
110 01 A000 Hull	X			X									255 10 F30K Mn Condensate Piping	X										
111 01 A101 Shell Plating	X			X									255 11 F30K Feed Wtr Piping Sys	X										
114 01 A101 Shell Appendages	X			X									255 12 F30B Emergency Feed Pump	X										
116 01 A300 Hull Framing	X			X									255 13 TH04 FW Drain Tank/Pump	X										
120 01 A800 Hull Bulkheads	X			X									255 14 F30D Emer Fd Bstr Pmp MD	X										
123 01 A900 Trunks/Enclosures	X			X									256 01 FB00 SW Circulating Sys	X										
130 01 A501 Hull Decks	X			X									256 02 310E SSTG Circulat Pump	X										
140 01 A500 Platforms/Flats	X			X									256 03 FB01 Mn Circulat Pump MD	X										
150 01 A600 Deck House	X			X									256 04 FB03 Mn Circulat Pump TD	X										
150 02 A604 Expansion Joints	X				X								258 01 TH04 HP Steam Drain Sys	X										
161 01 AA01 Stern Tubes		X		X									259 01 F601 Mn Prpln Uptakes	X										
161 02 AA01 Shaft/Prop Struts		X			X								261 01 F500 FO Service System	X										
161 03 AA01 Rudder Bearing Trk		X			X								261 02 F501 Mn FO Svce Pump TD	X										
162 01 F601 Stacks and Macks	X				X								261 03 F503 Mn FO Svce Pump MD	X										
163 01 AB01 Sea Chests	X			X									261 04 F505 P/C/R FO Svce Pump MD	X										
165 01 AF01 Sonar Domes	X			X									262 01 FD00 Mn LO System	X										
167 01 AD01 WT/AT Doors	X			X									262 02 FD01 Mn LO Svce Pump TD	X										
167 02 AD05 Hatches	X			X									262 03 FD03 Mn LO Svce Pump MD	X										
167 03 AD06 Seuttles	X			X									262 04 FD07 Mn Lub Oll Purifier	X										
167 04 AD06 Manholes/Covers	X			X									262 05 T304 Eletrst Precipitatr	X										
169 01 AD00 Spcl Prp Closures	X			X									264 01 FD00 LO Fill/Xftr/Purif	X										
171 01 AE01 Masts	X			X									311 01 310C SSTG Set 60 HZ	X										
171 02 AE06 Towers	X			X									312 01 330I Emer Diesel Gen	X										
171 03 AE05 Tetrapods	X			X									312 02 330B Emer Gas Turb Gen	X										
172 01 AF03 Kingposts	X			X									313 01 410D Batteries/Chargers	X										
179 01 AE07 Service Platforms	X			X									314 01 4700 MG Sets	X										
182 01 AJ01 Prpln Plant Fdns	X			X									314 02 4700 Line Volt Regulator	X										
183 01 AJ03 Electric Plant Fdns	X			X									314 03 4700 Rectifiers	X										
184 01 AJ03 Command/Surv Fdns	X			X									314 04 4000 Pwr/Ltg Xfmr	X										
185 01 AJ03 Aux Systems Fdns	X			X									314 05 4700 Voltage Monitors	X										
186 01 AJ03 Outfit/Furnishing Fdns	X			X									314 06 4700 Volt/Freq Monitors	X										
187 01 AJ03 Armament Fdns	X			X									321 01 430B Ship Svce Cable Sys	X										
192 01 AJ04 Oil and Water Tanks	X			X									321 02 4306 Shore Pwr Term Box	X										
200 01 U504 Sea Trial	X			X									323 01 4800 Casualty Power Sys	X										
200 02 Machy Vibration	X			X									324 01 4100 Swbds and Panels	X										
200 03 Relifient Mounts	X			X									324 02 4300 Emergency Power	X										
221 01 F101 Boiler	X			X									324 03 4300 Bus Xfr Switches	X										
221 01 F103 Press Fired Boiler	X			X									331 01 4500 Lighting Cables	X										
221 02 F101 Auto Combs/Fdw Cont	X			X									331 02 4503 Ltg Panels/Boxes	X										
221 02 F103 Auto Combs/Fdw Cont	X			X									332 01 4505 Lighting Fixtures	X										
231 01 FB00 Prpln Steam Turbine	X		X										341 01 310D SSTG Lube Oil Sys	X										
241 01 FC01 Main Reduction Gear	X			X									342 01 3300 Diesel Support Sys	X										
243 01 FE03 Stern Tube Seal	X			X									343 01 3308 Gas Turb Sprt Sys	X										
243 02 FE03 Internal Shafing	X			X									411 01 5 WDS/WDE	X										
243 03 FE03 External Shafing	X			X									411 02 G TDS System	X										
244 01 FE03 Line Shaft Bearing	X			X									411 03 QM06 AN/UVA Displays	X										
244 02 FE03 Stern Tube Bearing	X			X									411 04 P800 AN/SYA Displays	X										
244 03 FE03 Strut Bearing	X			X									412 01 Q Data Processing Sys	X										
245 01 FE06 Propeller	X			X									413 01 Q Digital Data Swbds	X										
251 01 F401 Forced Draft Blower	X			X									414 01 Q Cmd Cont Ifc Eq	X										
251 02 F103 Supercharger	X			X									415 01 Q Dgtl Data Coran Cont	X										
252 01 FJ01 Prpln Cont Console	X			X									417 01 Command Cont Swbds	X										
253 01 F700 Mn Steam Piping Sys	X			X									417 02 WDS/WDE/TDS Swbds	X										
254 01 FA00 Main Condensing Sys	X			X									421 01 LF00 Misc Nav Aids	X										
254 02 310E SSTG Condensing Sys	X			X									421 02 LG00 Magnetic Compass	X										
254 03 F80K Gland Cond Exh Fan	X			X									421 03 LH00 Metrl Instruments	X										
254 04 F80G Gland Exh/Lkoff Cnd	X			X									422 01 LJ00 Navigational Lights	X										
255 01 F30J Deraerating Fd Tank	X			X									422 02 TDF1 Helicopter Lights	X										
255 02 F303 Main Feed Pump	X			X									423 01 LJ100 Loran	X										
255 03 F30H Mn Condensat Pmp MD	X			X									423 02 LJ600 Tacan	X										
255 04 F30G Mn Condensat Pmp TD	X			X									423 03 N900 Radio DF System	X										
255 05 F30E MF Booster Pump TD	X			X									423 04 L300 Omega	X										
255 06 F309 MF Booster Pump MD	X			X									423 05 L700 Electronic Sextant	X										
255 07 F30E Reserve Fd Xfr Pump	X			X									424 01 R500 Navigation Sonar	X										
255 08 F30E Reserve Fd Xfr Pr Pump	X			X									426 01 LB00 Gyrocompass Sys	X										
255 09 F30E Reserve Fd Xfr Pr Pump	X			X									426 02 LC01 Underwater Log Sys	X										
255 09 F303 SSTG Condensate Pump	X			X									426 03 LD00 Dead Reckoning Sys	X										

	Detail Relative to SWBS			Detail Relative to EIC			Detail Relative to SWBS			Detail Relative to EIC		
	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater	Less	Same	Greater
431 01 4100 IC Switchboards	X			X			172 03 M700 ECM Recorder	X		X		
432 01 M401 Dial Telephone Sys	X			X			473 01 N100 Torpedo Decoy	X		X		
432 02 M403 SF Telephone Sys	X			X			473 02 NH06 AN/SIQ-25 Torp CM	X			X	
432 03 M400 Ckt F and Ckt FM	X				X		474 01 GE100 Mk 28 CHAFFROC Sys	X		X		
432 04 M400 Ckt MJ Mult Talk	X				X		475 01 N400 Degaussing Systems	X		X		
433 01 M301 Central Ampl Aneg	X			X			481 01 G6000 GFCS	X		X		
433 02 M303 IC Announcing Sys	X			X			481 02 G700 Misc GFC Eqpt	X		X		
433 03 M304 Ckt CK NTDS Comm	X			X			481 03 GY00 Gun Sys Test Eqpt	X		X		
434 01 M100 Tng/Entertainmnt TV	X			X			482 01 5000 GMFC Systems	X		X		
434 02 M700 Ckt SE Entertainment	X			X			482 02 5F00 GMFC Checkout Eqpt	X		X		
434 03 M701 Ckt MP Snd Mtn Pict	X			X			482 03 5H000 Misc GMFC Eqpt	X		X		
434 04 M700 Portable Projectors	X			X			483 01 J000 ASW FCS	X		X		
435 01 M306 Voice Tube/Msg Pass	X			X			483 02 J000 UW FC Support Eqpt	X		X		
436 01 M500 Alm/Saf/Wrn Sys	X			X			489 01 G000 GFC Swbd	X		X		
437 01 M600 Ind/Order Sys	X			X			489 02 5000 GMFC Swbd	X		X		
437 02 LH07 Ckt HD/HE Wd Dir/Sp	X			X			489 03 J000 UB FC Swbd	X		X		
439 01 M100 Television Systems	X			X			491 01 W000 Electronic Test Eqpt	X		X		
439 02 M700 Recording Systems	X			X			505 01 U603 Piping Insul/Lag	X			X	
441 01 Q100 Comm Antenna System	X			X			511 01 T100 Compartment Heaters	X		X		
441 02 Q900 Antenna Tuning Sys	X			X			511 02 T10A Steam Heating Sys	X			X	
441 03 Q800 Antenna Xfr Sys	X			X			512 01 T300 Ventilation System	X			X	
441 04 QC00 Radio Remote Cont	X			X			513 01 T300 Mech Rms Vent Sys	X			X	
441 05 QB00 Comm Receivers	X			X			514 01 T404 Air Cond Plant	X			X	
441 06 QD00 Comm Transceivers	X			X			514 02 T404 Air Cond Piping Sys	X			X	
441 07 QE00 Comm Transmitters	X			X			514 03 T404 Air Cond Sntn Unit	X			X	
441 08 Q700 Audio Amplifiers	X			X			516 01 T500 Refrigeration Plant	X			X	
441 09 Q600 Terminal Voice Sys	X			X			517 01 T104 Aux Boiler Sys	X			X	
441 10 QP00 Sat Comm	X			X			520 01 T800 Sea Water System	X			X	
441 11 QS00 Quality Monitoring	X			X			521 01 T801 Firemain System	X			X	
441 12 QR00 Comm Spcl Test Eqpt	X			X			521 02 T803 Flushing System	X			X	
441 13 QN00 Microwave Comm Sys	X			X			521 03 T801 Fire Pumps MD	X			X	
441 14 QQ00 Special Comm Sys	X			X			521 04 T801 Fire Pumps TD	X			X	
442 01 R600 UW Comm System	X			X			521 05 T801 Prmg Rtry Fire Pump	X			X	
442 02 QJ04 AN/SSQ-1A Sonobuoy	X			X			521 06 1801 Gas Fire Pump P-250	X			X	
443 01 QA00 Infrared Systems	X			X			522 01 T804 Sprinkler Systems	X			X	
443 02 LF00 Audible Comm Sys	X			X			523 01 T805 Washdown System	X			X	
443 03 LK00 Signalling Lights	X			X			524 01 T805 Aux SW Cooling Sys	X			X	
445 01 Q300 Teletype Systems	X			X			524 02 T806 Aux SW Cooling Pump	X			X	
445 02 QL00 Facsimile Systems	X			X			526 01 TC00 Scuppers/Deck Drain	X			X	
445 03 Q400 Terminal Switch Sys	X			X			528 01 T706 Plumbing Drainage	X			X	
446 01 QE00 Cryptographic Sys	X			X			529 01 TA01 Main Drainage Sys	X			X	
450 01 P900 Radar Distr Sys	X			X			529 02 TA01 Secondary Drainage	X			X	
450 02 P700 Radar Displays	X			X			529 03 TA03 Bilge/Ballast Sys	X			X	
450 03 PC00 Radar Trainers	X			X			529 04 TH07 FO Stripping System	X			X	
450 04 PF00 Radar Aux Devices	X			X			529 05 T607 FO Stripping Pump	X			X	
450 05 PB00 AEW Terminal Eqpt	X			X			531 01 TK00 Distilling Plant	X			X	
451 01 P100 Surf Search Radar	X			X			531 02 TK00 Distill Feed Pump	X			X	
452 01 P300 Air Search Radar 2D	X			X			531 03 TK00 Dist Itr Drain Pump	X			X	
452 02 P503 Air Search Radar 2D	X			X			531 04 TK00 Distillate Pump	X			X	
453 01 P400 Hgt Finder Radar 3D	X			X			531 05 TK00 Dist Brine Ovhd Pump	X			X	
453 02 P31 Hgt Finder Radar 3D	X			X			533 01 TB01 Fr Water Sys	X			X	
453 03 P540 Hgt Finder Radar 3D	X			X			533 02 TB03 FW Chlorination Sys	X			X	
455 01 P600 IFF System	X			X			533 03 TB05 Hot Fresh Wtr Pump	X			X	
459 01 PE00 Satellite Trk Radar	X			X			533 04 TB03 Priming FW Pump	X			X	
460 01 R800 Special Sonar Sys	X			X			533 05 IC03 Drinking Wtr Cooler	X			X	
460 02 M700 Sonar Recorder	X			X			533 06 TB01 Hot FW Heater	X			X	
461 01 R100 Active Sonar System	X			X			533 07 TB03 SS Fresh Water Pump	X			X	
462 01 R900 Passive Sonar	X			X			533 08 TB03 Hot FW Washing Pump	X			X	
463 01 R100 Act/Palv Sonar Sys	X			X			533 09 TB03 Pre-itrace Bstr Pump	X			X	
463 02 R300 Var Depth Sonar Sys	X			X			534 01 TH01 Aux Exhaust Piping	X			X	
465 01 R700 Bathymeterograph Sys	X			X			534 02 TH03 LP Aux Steam Piping	X			X	
471 01 NB00 Active ECM Systems	X			X			534 03 TH03 HP Aux Steam Piping	X			X	
471 01 NC00 Active ECM Systems	X			X			534 04 FI00 Boiler Blow Piping	X			X	
471 01 NB00 Active ECM Systems	X			X			534 05 TH04 Steam Drain Collect	X			X	
471 02 ND00 ECM Test Eqpt	X			X			534 06 TH01 Aux Gland Leakoff	X			X	
472 01 N800 Passive ECM Systems	X			X			534 07 TH03 GI Seal/Vent Mn Tur	X			X	
472 02 N900 ECM DF System	X			X			534 08 TH03 GInd Seal/Vent SSTG	X			X	

Detail Relative to SWBS						Detail Relative to EIC						Detail Relative to SWBS						Detail Relative to EIC					
	Less	Same	Greater		Less	Same	Greater		Less	Same	Greater		Less	Same	Greater		Less	Same	Greater				
534 09 TH03 Mn Steam Reduc Stas			X				X						612 02 1103 Safety Nets			X				X			
534 10 TH04 Mn Turb Drain Piping			X				X						613 01 1300 Rigging and Canvas			X			X			X	
534 11 TH03 Dump Augment Valves			X				X						621 01 1501 Non-Strl Bulkheads			X			X			X	
535 01 TH04 Whistle Seam Drain			X				X						622 01 1404 Floor Plate Grating			X			X			X	
535 02 TH01 Atmospheric Exhaust			X				X						623 01 1403 Accommodation Ladders			X			X			X	
536 01 PG00 Radar Cooling Sys			X				X						623 02 1403 Movable Ladders			X			X			X	
536 02 RP00 Sonar Cooling Sys			X				X						623 03 1401 Fixed Ladders			X			X			X	
536 03 TB04 NTDS Cooling Sys			X				X						624 01 1503 Non-Strl Closures			X			X			X	
536 04 NE00 ECM Cooling Sys			X				X						625 01 1108 Airports/Windows			X			X			X	
536 05 TB04 JPTDS Cooling Sys			X				X						631 01 UF06 Painting			X			X			X	
536 06 TB04 FC Radar Clg Sys			X				X						633 01 1106 Zinc Anodes			X			X			X	
541 01 TD09 FO Transfer Pump			X				X						633 02 1106 Impres Cur Cath Sys			X			X			X	
541 02 TD08 FO Tank Level Ind			X				X						634 01 1601 Deck Covering			X			X			X	
541 03 TD06 FO Filling System			X				X						635 01 1701 Hull Insulation			X			X			X	
541 04 TD08 FO Transfer System			X				X						636 01 1000 Hull Damping			X			X			X	
542 01 T605 JP-5 Service Pump			X				X						637 01 1701 Sheathing			X			X			X	
542 02 T605 JP-5 Transfer Pump			X				X						638 01 1000 Refrigerated Spaces			X			X			X	
542 03 T605 JP-5 Piping System			X				X						640 01 1C00 Furn/Living Spaces			X			X			X	
542 04 T607 JP-5 Stripping Sys			X				X						644 01 T700 Extras/Sanitary Spaces			X			X			X	
543 01 T606 Aviation Lube Oil			X				X						651 01 1B01 Galley Equipment			X			X			X	
543 02 FD07 Gen Purpose Lub Oil			X				X						651 02 1B03 Scullery Equipment			X			X			X	
545 01 TF01 FO Tank Heating			X				X						652 01 1D00 Medical Spaces			X			X			X	
551 01 TF01 HP Air System			X				X						654 01 1A00 Utility Spaces			X			X			X	
551 02 TF03 LP Air System			X				X						655 01 1A01 Laundry Equipment			X			X			X	
551 03 TF01 HP Air Compressor			X				X						656 01 1A05 Trash Dspl Space			X			X			X	
551 04 TF03 LP Air Compressor			X				X						656 02 191V Paper Shredder			X			X			X	
551 05 TF03 MP Air Compressor			X				X						661 01 1C00 Office Furnishings			X			X			X	
551 06 TF04 Elex Dry Air Sys			X				X						662 01 1C00 Furn/Mehry Cont Ctr			X			X			X	
551 07 NT04 Prairie Masker Sys			X				X						663 01 1C00 Flex Cont Centers			X			X			X	
553 01 TG00 Oxygen Nitrogen Sys			X				X						664 01 1805 Damage Control Stas			X			X			X	
555 02 T906 CO2 Hose Reel Sys			X				X						665 01 1900 Workshop Equipment			X			X			X	
555 03 T903 Foam Fire Ext Sys			X				X						671 01 1800 Lockers/Spcl Stwg			X			X			X	
555 04 T901 CO2 Port Ext			X				X						672 01 1800 Storerm/Issue Rms			X			X			X	
555 05 T901 Dry Chem Ext			X				X						711 01 GB00 Gun Mounts			X			X			X	
555 06 T907 Stm Smothering Sys			X				X						711 02 GA00 Gun Turrets			X			X			X	
561 01 TL01 Steering Gear Sys			X				X						712 01 GW00 Ammunition Handling			X			X			X	
562 01 TL01 Rudder			X				X						713 01 A905 Ammunition Stowage			X			X			X	
566 01 TR00 Stabilizing Fins			X				X						721 01 5A00 GMILS			X			X			X	
571 01 TT01 Msl/Cargo Stream			X				X						721 02 JJ00 ASROC Launching Sys			X			X			X	
571 02 TT03 Fueling at Sea			X				X						721 03 JC00 ASW Launcher			X			X			X	
571 03 TT05 Non-Tensioned Eqpt			X				X						721 04 T804 Missile Bstr Supprs			X			X			X	
572 01 TN00 Ship Stores Hdlg			X				X						722 01 TT04 Missile Hdlg Eqpt			X			X			X	
572 01 TN00 Personnel Eqpt Hdlg			X				X						722 01 8600 Missile Handling Eqpt			X			X			X	
572 02 TT0C Vert Stores Cnvr			X				X						722 02 JJCA ASROC Handling Eqpt			X			X			X	
573 01 TS00 Cargo Handling			X				X						722 02 8500 UWS Handling Eqpt			X			X			X	
581 01 TM00 Anchor Handling Sys			X				X						722 03 8800 SWS Handling Eqpt			X			X			X	
582 01 TM05 Mooring/Towing Gear			X				X						722 04 8900 Mult Prp Hdlg Eqpt			X			X			X	
582 02 TM06 Warping Capstan			X				X						722 05 TT0A Weapons Elevators			X			X			X	
583 01 Y100 Personnel Boat			X				X						723 01 A905 Missile Stowage			X			X			X	
583 02 Y300 Utility Boat			X				X						723 02 A905 Rocket Stowage			X			X			X	
583 03 Y300 Motor Whle Boat			X				X						728 01 TB04 ASROC Clg/Htg			X			X			X	
583 04 YA00 CO2 Inflatable Boat			X				X						728 02 TB04 Anti Icing Systems			X			X			X	
583 05 YC00 Gen Boat Hdlg			X				X						751 01 JD00 Torpedo Tubes			X			X			X	
585 01 TP01 Antenna Operat Gear			X				X						752 01 JF00 Torpedo Hdlg Sys			X			X			X	
588 01 TU00 Helicopter Handling			X				X						752 01 8500 Torpedo Hdlg Sys			X			X			X	
593 01 T700 Sewage Trtmt Sys			X				X						752 01 8900 Torpedo Hdlg Sys			X			X			X	
593 02 1B03 Garbage Disposal			X				X						753 01 A905 Torpedo Stowage			X			X			X	
593 03 T700 Garbage Dspl Pump			X				X						761 01 GF00 Saluting Guns			X			X			X	
611 01 1100 Hull Fittings			X				X						761 02 8A00 Night Vision Slight			X			X			X	
612 01 1103 Rails/Stan/Lifeline			X				X						763 01 A905 Small Arms Stowage			X			X			X	

APPENDIX C

ANALYSIS OF CURRENT 3M REPORTING AT INDIVIDUAL APL LEVEL

The data contained in this appendix provide an analysis of 3M "level-of-reporting" practices, based on a review of FF-1052 Class maintenance history for calendar year 1974. The tables of this appendix show the following information for the top 150 EIC equipment (third indenture) level items:

- a. Rank, based on total quantity of maintenance man-hours reported at the organizational level.
- b. Total number of class maintenance actions reported for that item.
- c. The percentage of those items that were reported at the major equipment (e.g., "boiler", "main feed pump", "dishwasher", "motor whaleboat") APL/AEL level.
- d. The percentage of those items that were reported at the component (e.g., valve, relay, controller) APL/AEL level.
- e. The percentage of those items that were not APL/AEL related.

The data in this appendix identify the specific ship systems/equipments that would be affected by relaxation of 3M APL/AEL reporting criteria. An additional potential use of the data is to identify items that appear to warrant selective consideration if it is desired to augment existing reporting criteria, or subdivide existing RIRs, with the objective of enhancing the current reliability and maintainability analysis capability.

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM ADMINISTRATION, HAB, OUTFIT & FURNISHINGS

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
1B01	Galley Equipment	7	755	50.3	0	49.7
1000	Admin., Hab., etc. (General)	17	983	0	2.3	97.7
1910	Mechanical Cleaning Equipment	34	15	6.6	0	93.4
1600	Deck Covering	40	198	0	0.5	99.5
1A01	Laundry Equipment	52	295	58.9	14	27.1
1108	Miscellaneous Fittings	54	266	0	3	97
1C01	Living, Office, Cont. Center, Machinery Space Furnishings	56	391	0	3.1	96.9
1103	Safety and Guard Fittings	59	330	0	0	100
1C00	Living, Office, Cont. Center, Mach. Space Furn. and Equipment	80	278	2.7	2.7	94.6
1B03	Scullery Equipment	82	246	56.7	11	33.3
1700	Hull Insulation, Sheathing	83	129	0	0	100
1B01	Firefighting Locker	92	46	5	42.8	52.2
1A06	Misc. Items Mfr. by Tender	97	509	0	1.3	98.7
1503	Doors, Structural	100	146	0	4.1	95.9
1100	Hull Fittings	104	103	0	6.8	93.2
1001	Medical, Dental Equipage	121	49	0	0	100

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM ADMINISTRATION, HAB., OUTFIT & FURNISHINGS

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM ELECT. POWER GENERATION & DISTRIBUTION

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
310C	Generator Set, 60Hz, TD	22	601	66.9	26.4	6.7
310E	Auxiliary Condenser	31	315	65.0	26.7	8.3
4505	Permanent Light Fixtures	33	393	0	53.9	46.1
3301	Emergency Gen. Set, 60Hz Diesel	36	223	78.9	18.0	3.1
310D	SSTG, L.O. System	74	202	27.4	47.3	25.3
3101	SSTG, 60Hz Diesel	88	184	71.7	24.0	4.3
4703	MG Set 60-400Hz	96	184	34.8	63.6	1.6
3300	Emergency Gen. Plants	132	31	64.5	32.3	3.2
4101	Ships Serv. Switchboards, 60Hz	138	96	63.5	30.2	6.3
3100	Ships Serv. Gen. Plants	145	54	51.8	44.5	3.7

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM HULL STRUCTURE

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
A000	Hull Structure (General)	23	298	0	3.3	96.7
A501	Decks	38	90	0	0	100
A905	Compartments	39	143	0	4.2	95.8
AD05	Hatches, WT	42	122	0	0.8	99.2
AD01	Doors, WT	45	258	0	0.4	99.6
A603	Expansion Joints	58	50	0	4.0	96.0
A601	Superstructure Blkhds.	65	43	0	0	100
AB01	Scoop, Cond. Injection, Sea Chest	109	41	0	0	100
A600	Superstructure	124	48	0	0	100
A904	Tanks	135	48	0	0	100
A304	Pillars and Stanchions	140	33	0	0	100

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM PROPULSION SYSTEM

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
F101	Boilers	1	1905	63.7	25.0	11.3
F303	Main Feed Pump Unit (Turb. Driven)	8	550	78.2	81.1	2.9
F703	Main Steam Valves	11	142	0	70.4	29.6
F401	Blower Group, Air Supply	12	620	0	95	5
F801	Turbine, H.P., Mn. Prop.	21	128	78.9	15.6	5.5
F100	Steam Gen. & Controls	28	239	21.4	40.9	37.7
FD00	Lube Oil System	41	114	19.3	28.9	51.8
F30H	Main Condensate Pump	43	87	74.7	23.0	2.3
F30K	Piping, Valves, Mn. Cond.	44	271	8.1	59.8	32.1
FD07	Lube Oil Syst. Piping, etc.	50	218	18.3	51.0	30.7
F701	Main Steam Piping	64	133	0	30.8	69.2
F507	F.O. Piping and Access	68	320	0	55.9	44.1
F300	Mn. Feed and Cond. System	75	102	20.6	51.0	28.4
F000	Mn. Prop. System	77	172	10.0	18.5	71.5
F704	Main Steam Accessories	79	244	0	58.2	41.8
F309	Mn. Feed Pump Unit (Mtr. Driven)	85	116	86.7	10.4	3.4

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM PROPELLION SYSTEM

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM SURFACE MISSILE, GUN AND ASW SYSTEMS

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
GB19	5"/54, MK 42, MOD 9	3	1306	0	91.9	8.1
G12M	AN/SPG 53A Radar	18	939	91.3	7.0	1.7
JP43	MK 53, MOD 0, 1 Attack Console	20	523	91.0	2	7
JJ61	ASROC Launcher MK 112, MODS 1, 2, 3, 4	35	496	0	87.7	12.3
G11K	MK 68, MOD 3 Gun Director	49	375	?	?	5.3
G17A	MK 47 MODS 10, 11 Computer	70	321	?	?	1.0
JJ00	ASROC Launch Group	73	202	0	60.4	39.6
5AEB	MK 25, MOD 1 Launching System	89	396	0	97.5	2.5
G100	MK 68 GFCS	102	182	53.3	31.9	14.8
5BEA	MK 76, MOD 0 Director	108	174	96.7	1.0	2.3
G142	MK 1, MOD 1 Radar Signal Processing Eq.	117	136	?	?	7.4
G12Q	AN/SPG 53D Radar Set	141	75	?	?	22.7

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM NAVIGATION, INTERIOR COMM. AND COUNTERMEASURES

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM RADAR, IFF, COMMUNICATIONS & SONAR

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
R13R	AN/SQS-26CX	2	1491	97	1.3	1.7
P30U	AN/SPS 40A Radar Set	6	308	97	1.7	1.3
R13S	Sonar Power Supply	10	379	?	?	10.0
R30B	AN/SQA-13	13	363	?	?	9.4
QE1N	AN/URT-23(V)	26	262	?	?	14.5
R30L	AN/SQS-35(V)	37	330	?	?	22.4
P118	AN/SPS 10F Radar Set	47	361	?	?	0.8
P716	AN/SPA 50A	48	154	88	10.7	1.3
R50Z	AN/UQN-4	69	196	70.9	21	8.1
P60Y	AN/UPX 11	72	55	94.5	3.7	1.8
P71F	AN/SPA-66 Indicator Group	78	202	95	4.5	.5
Q931	AN/SRA-51 Coupler	98	101	93	1.1	5.9
QB3A	R-1051B Radio Receiver	103	389	98	1.7	.3
P31W	AN/SPS-40D	105	72	100	0	0
Q000	Communications System	109	99	11		39
R900	Sonar Systems, Passive	115	3	0	0	100

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM RADAR, IFF, COMMUNICATIONS & SONAR

SUMMARY OF MAINTENANCE ACTIONS

MAJOR SYSTEM AUXILIARY SYSTEMS

EIC	ITEM	RANK	MAINTENANCE ACTIONS			
			TOTAL NO.	% EQ. APL	% COMP. APL	% NO. APL
TK03	Distilling Plant L.P. Flash Type	4	699	40.9	52.7	6.4
T801	Firemains	5	453	37.5	33.1	29.4
T404	Air Cond. System (Chilled Water) CR-12	14	544	29.1	40.9	11.8
TF03	IP & LP Air Systems	19	460	48.5	32.5	19.0
TF01	HP Air System	24	453	62.2	28.7	9.1
T800	Firemain, Etc. Salt Water Systems	25	248	33.9	34.2	31.9
TR01	Stabilizer	46	183	67	29.7	3.3
TH04	HP/LP Drains	51	255	10	57.8	32.2
TB00	Fresh Water Systems	55	203	15.7	55.7	28.6
T300	Ventilation Systems	62	382	15	29.5	55.5
TB06	Sea Water Serv. System	66	122	25	37.3	37.7
T503	Refrigeration Plant	76	228	39	47	14.0
TH00	Aux. Steam Exhaust System	84	113	0	39	61
T804	Sprinkling Systems	86	360	0	37.2	62.8
TM03	Ground Tackle	87	108	0	20.3	79.7
T000	Auxiliary Systems (General)	90	164	6	37.3	56.7

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